ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

SEPTEMBER 1950

FOUNDED 1866

TO DEFEND CIVILIZATION

Is the mining industry prepared?

A program for the mining industry

A program for Government

SEE PAGES 66 TO 69

Special: **Airborne radioactivity surveying speeds up uranium search.** PAGE 74

How HYDROSEAL PUMPS CUT DOWN COSTS IN COAL PRODUCTION

Here are two of the six Hydroseals in the cleaning plant of a major coal producer. Four pumps (two standbys) handle ¼-O-inch coal sludge at about 40% concentration; two others pump middlings that have been crushed to ¾-inch top size. Service-proven in 20 months of two-shift operation.

Hydroseals mean larger coal profits, because their initial high efficiency is maintained throughout the life of the pump, thanks to Hydrosealing and abrasion-resistant ASH-21 Alloy Pumping Parts. Power and service costs are thus reduced to a minimum.

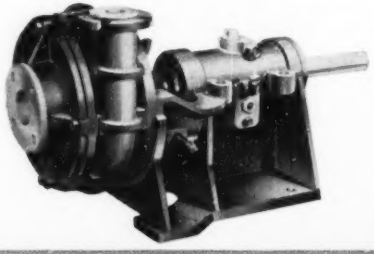
Thousands of Hydroseals—in all parts of the world—are proving that they offer the best solution to these coal-mine jobs:

1. **Circulation of sand, sludge, or lump-coal in hydraulic cleaning operations.**
2. **Pumping tipple or breaker refuse to storage piles or fills.**
3. **Moving coal to distant locations for storage or from mine to preparation plant.**
4. **Reclaiming culm banks.**
5. **Pumping overburden in hydraulic stripping operations.**
6. **Cleaning muck from reservoirs and sumps.**

ASH

Our engineers will be glad to tell you how you can add to your coal profits with Hydroseals. Write to . . .

THE ALLEN-SHERMAN-HOFF CO.
229 South 15th Street • Philadelphia 2, Pa.
Offices and Representatives in Most Principal Cities



HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

Why do it the hard way?

This NEW JL-4 JACKLEG makes Jackhamer drilling much FASTER and EASIER!

and increases footage up to 50% or more

Where Jackhamers are used for other than down-hole work, Ingersoll-Rand's *new* JL-4 Jackleg makes it easier for the operator — saves valuable manhours — and gives more footage per shift. The I-R Jackleg replaces muscle power with *air power* — to support the drill, feed it and absorb the recoil.

The *new* JL-4 is the result of 10 years' experience in manufacturing and applying Jacklegs. It embodies many important new developments in this type of mounting ... A 4-foot feed permits the use of longer steel changes made possible by Ingersoll-Rand Carset Jackbits ... An improved roller-type pressure control valve, adjustable in 5-pound increments, gives exact and easier control of feed leg pressure ... A finger-tip bleed-off button gives just the right amount of pressure release for drilling through seamy and fitchery ground ... The bayonet type of connection between the drill and the Jackleg allows instant disassembly and easy transport from one location to another ... Also, hardened clamping plates that hold the drill are inexpensively renewed without replacing the entire arm. The smaller JL-3 Jackleg is available when requested.

For full information, see your I-R representative.

524-5

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N.Y.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Less belt damage, less "spill" with B. F. Goodrich cord belts

THIS B. F. Goodrich oilproof beltroad handles washed and sized coal from plant to river barges on a retractable conveyor system. Cord belts keep centered on idlers, require less maintenance because cords are free to flex. No spillage; troughs better even when running empty. Longer centers, higher lifts can be used. Creasing action between idlers is eliminated.

Each lengthwise cord in this B. F. Goodrich belt is completely surrounded by rubber — no cross threads tie them together. The rubber-borne cord body has practically the same impact resistance as the cover itself. Cords are free to "give" when an impact occurs. It distorts temporarily, distributing and absorbing a shock that would damage stiff, unyielding plies.

In addition to the regular cord body in a B. F. Goodrich cord belt, a patented *Transcord breaker* has been added. It's an extra layer of parallel cords in rubber, placed across belt width.

The impact cushion of the cord belt resists cuts and gouges; the Transcord breaker keeps the cover from stretching beyond elastic limits, provides better adhesion between cover and carcass. With each tightly twisted cord completely sealed in rubber, the cord belt resists effects of acid materials, moisture, mildew.

The first B. F. Goodrich cord belt ever made is still on the job after 12 years and over 14 million tons of coal handling. The cord belt was developed by B. F. Goodrich for tough coal and rock hauling jobs. Call in your local BFG distributor, or write: *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Conveyor Belts BY
B.F.Goodrich
RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

84th YEAR OF PUBLICATION

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REDUCE COSTS

of compressor operation by using the air compressor oils exactly suited to YOUR operating conditions . . . TEXACO

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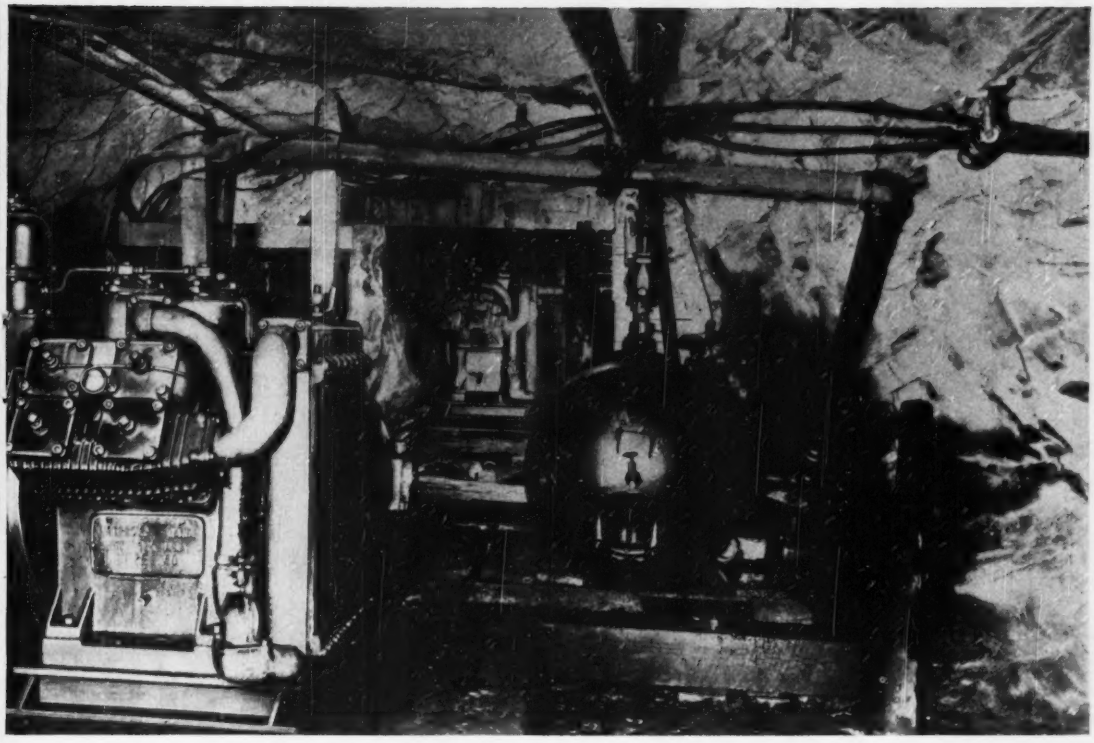

AIR COMPRESSORS operate under a variety of conditions—and there is no one oil that will do a highly satisfactory lubricating job under all of them. But there is a Texaco air compressor oil to meet every requirement. Follow the recommendations of your Texaco Lubrication Engineer and—whatever your conditions—you'll assure more efficient, more trouble-free performance . . . reduced wear and lower maintenance costs.

For instance, where conditions tend to produce rust in any part of the system, there are Texaco *rust-inhibited* air compressor oils designed to prevent it. If service is very severe and carbon and gum are problems, one of the Texaco *heavy-duty* air compressor oils will assure clean operation. Under "wet" cylinder conditions, use a Texaco *compounded* air compressor oil . . . and a Texaco *straight mineral* air compressor oil for normal conditions.

Also follow your Texaco Lubrication Engineer's recommendations for lubrication of your drills. *Texaco Rock Drill Lubricants EP* are "extreme pressure" lubricants designed to protect against wear and rust . . . assure longer life and lower maintenance costs.

Talk to a Texaco Lubrication Engineer about these cost-saving lubricants. Call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels

FOR THE MINING INDUSTRY

35 m.p.h. "C" HAULS

. . . converts to STRIP

Other interchangeable tools for C TOURNAPULL

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16 ton bottom dump
TOURNAHOPPER

20 ton flat bed
TOURNAHAULER

15-ton
TOURNACRANE

6 or 7-yd.
TOURNAMIXER

SHOVEL ROCK

with 16-ton rear-dump TOURNAROCKER

17 heaped yard capacity

8' x 12'5" bowl for big target

13'9" turning radius with 15 11" wheelbase

4-wheel air brakes with 4176 sq. in. brake surface

Big 21.00 x 25 low-pressure tires

Simple electric body hoist

Weighs approx. 36,800 lbs. complete

Here's just *one* profitable use for versatile, 35 m.p.h. C Tournapull prime mover in mines and quarries. Coupled to 16-ton, rear-dump Tournarocker, it's a big-production hauler. Operator takes it through its cycle at top speed, with complete safety, because Tournarocker has 4,176 sq. in. of braking surface — *more on one wheel than most haulers have on all four.* Holding action of powerful 4-wheel, disc-type air brakes, plus *front-wheel drive,* let Tournarocker back up to edge of bank, dump load clear. Eliminates rehandling, saves dozer clean-up. Simple electric hoist (no troublesome hydraulics) tips body to vertical position. Smooth, clean, streamlined bowl clears loads instantly. In addition to big-payload, and fast-cycle hauling with Tournarocker . . . money-saving interchangeability with Carryall *doubles* Tournapull's earning capacity for mine and quarry owners. For example . . .

SCRAPER DIRT

with 13.5 cu. yd. CARRYALL SCRAPER

16-ton load capacity

Finger-tip electric control on apron, bowl, load-ejector tailgate

Open-top bowl for shovel loading

4-wheel disc-type air brakes

21.00 x 25 tires interchangeable with prime mover or Tournarocker

Total weight approx. 34,500 lbs.

For less than 25% of the cost of the original unit, the Tournarocker interchanges with a scraper . . . is ready to strip overburden, move spoil banks, build and surface haul roads. All you need is Carryall body — same Tournarocker wheels and tires can be switched to Scraper, substantially reducing cost of unit interchangeability. The giant 21.00 x 25 tires assure ample flotation in mud. Constant-pull, power-proportioning differential also reduces weather delays . . . gives positive traction on soft banks and slick pit grades.

Thus, Carryall and Tournarocker keep your "C" prime mover working and earning all year 'round. Other auxiliary hauled units, shown below, further save time and reduce equipment investment per job. 3 diesel engines, 165, 180, and 186 h.p. are available in the "C" prime mover to best fit your requirements. Your LeTourneau Distributor can also show you this money-saving Tournapull package in both *larger* and *smaller* sizes. Call him TODAY!

LETOURNEAU PEORIA, ILLINOIS — JOB-PROVED over 6750 Built and Shipped — **TOURNAPULLS**

MORE YARDS PER HOUR WITH RUBBER-TIRED POWER

Big Taconite Program Started in Minnesota
IRON ORE—A Global Outlook
April 17, 1950
U. S., Reds: Ore Resource Rivals
FUTURE ORE SUPPLIES

ORE BENEFICIATION

Through A-C Equipment and Engineering

FOREIGN ORE DISCOVERIES ARE GOOD NEWS, but domestic mines still will supply the bulk of the ore consumed in the U. S. Problems of transportation and availability will assure this. *One thing certain* in this changing picture, more mining, processing and handling will be required on domestic ores as quality lowers.

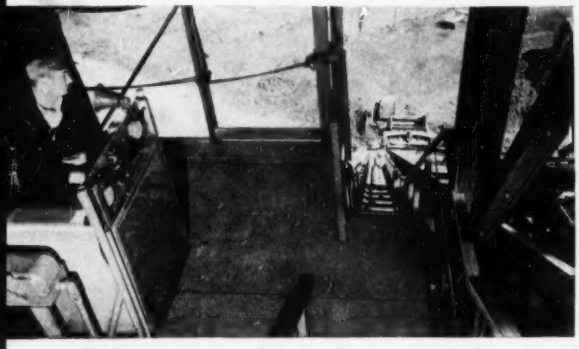
In iron mines throughout U. S., Allis-Chalmers equipment for half a century has been processing ores for the steel industry. Its research, engineering and experience is today helping ore producers meet the challenge of economical beneficiation of leaner ores and taconites.

Operation photos, below and right, show A-C ore beneficiation equipment now in wide use. Allis-Chalmers offers you this kind of *undivided responsibility* for process, drive and control equipment all along your flow sheet.

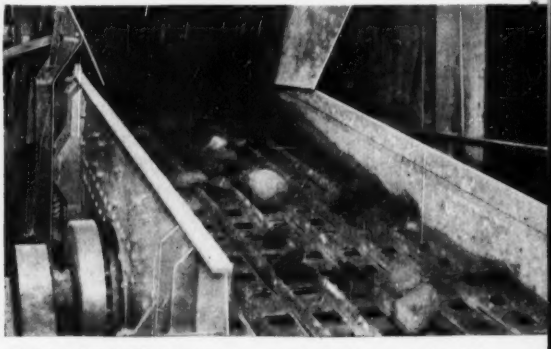
A-C also operates a complete commercial research laboratory and pilot plant to aid you in developing new processes. For detailed information on equipment and services, call your nearest A-C office. A-3095

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

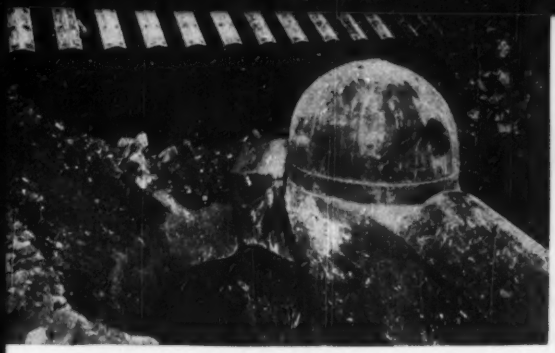
Texrope, *Hydrocone* and *Low-Head* are Allis-Chalmers trademarks.



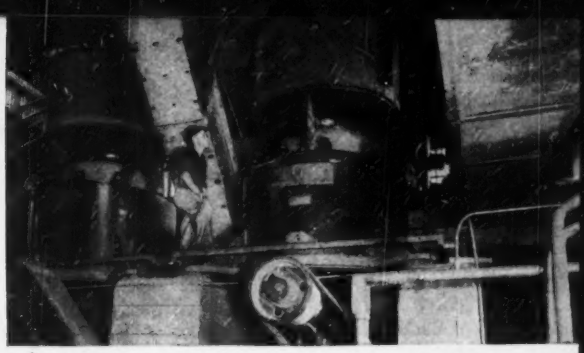
1 **SINCE UP TO THREE TONS** of ore are needed to produce one ton of concentrate, large quantities of low grade ore must be removed from the deepening mines. Mesabi range mine skip hoist above is A-C, built by the *only* manufacturer of hoists and *all* auxiliaries.



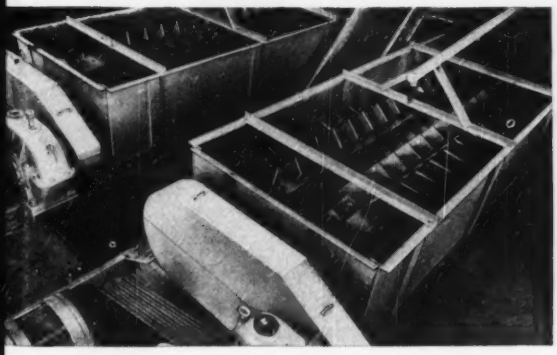
2 **FINES ARE OFTEN SCALPED** from run-of-mine ore on sturdy 1000 tph Style C vibrating screens like this one at a Minnesota iron mine. Allis-Chalmers builds *six* separate types of vibrating screens to meet varying beneficiation requirements.



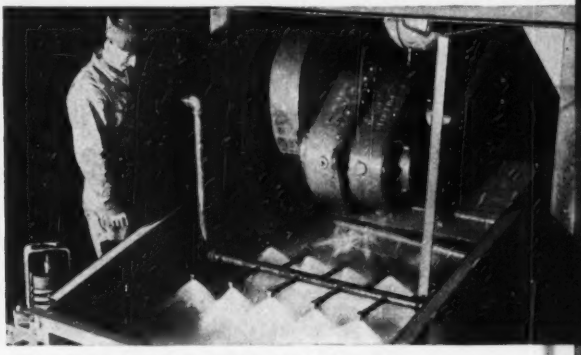
3 **TOUGH, ABRASIVE, LOW GRADE** iron ores are crushed in high output primary gyratory and jaw crushers. This 60-in. Superior• McCully crusher is in use in the Lake Superior region. Write for Bulletin 07B6004 for complete details on this type of crusher.



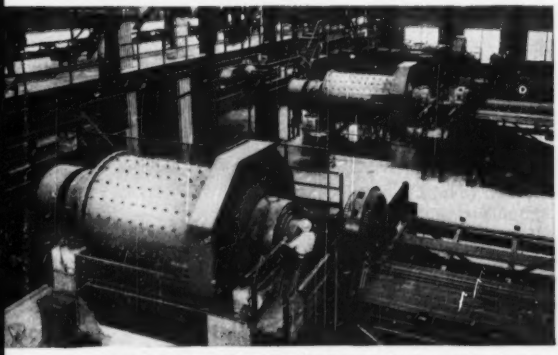
4 **FINE REDUCTION** of the iron ore is often accomplished with *Hydrocone* gyratory crushers. Two are seen working in parallel at this Adirondacks iron mine and beneficiation plant. Write for Bulletin 07B7145 for complete description and operating data.



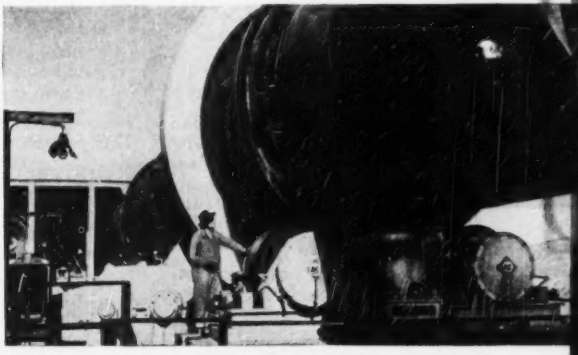
5 **THESE LOG WASHERS** are used to remove silica and medium sticky clay from crushed iron ore. Contra-rotating steel paddles produce a scuffing, scouring and sluicing action. Allis-Chalmers makes all basic types of washing equipment. See Bulletin 07B6411.



6 **IN CONCENTRATING IRON ORE** by the heavy density process, *Low-Head* vibrating screens are widely used for recovering media. The first screen section drains the media while the second section washes at this Minnesota plant. Write for Bulletin 07B6330.



7 **IRON ORE IS FINELY GROUND** in three A-C 8 ft x 12 ft rod mills ahead of magnetic separation at this Adirondack plant. A-C builds *five* separate types of grinding mills to meet varying plant requirements. Request Bulletin 07B6718 for full details.



8 **NODULIZING OF BENEFICIATED IRON ORE** so that it can be used efficiently as blast furnace feed is the job of this Allis-Chalmers 11 ft, 6 in. x 300 ft rotary kiln at a southern iron mine and beneficiation plant. Bulletin 07B6368 contains full description.

EQUIPMENT FOR IRON ORE BENEFICIATION: Hoists . . . Jaw and gyratory crushers . . . Vibrating screens . . . All types of washers . . . Concentrating jigs . . . Grinding mills . . . Rotary kilns and coolers . . . Centrifugal pumps . . . *Texrope* V-Belt drives and sheaves . . . All types and sizes of Electric motors . . . Starters . . . Complete power generation, distribution, control equipment. Write for literature.

ALLIS-CHALMERS

Power, Electric, Processing Equipment for Iron and Steel

WHY MINE OPERATORS GET

J&L STEEL

30% to 60% Longer Service

FROM WIRE ROPE OF THIS DESIGN

Mine operators get 30% to 60% and even *longer* service from wire ropes of this unique design because *it has more steel and fewer voids than any conventional wire rope!* Result: Higher strength . . . Greater flexibility . . . Easier handling . . . Longer life.

Published records prove that this wire rope, when used in applications for which it was designed, reduces operating costs, diminishes downtime and increases profits.

Known as CENTERFIT, an exclusive J&L wire rope, it is laid together in *one* operation. All strands run in the *same* direction. Outside strands fit snugly into valleys between inside strands, eliminating crossing as in conventional designs. *This prevents internal nicking.*

CENTERFIT is recommended for *hoist lines, closing lines, cable controls* on earth moving equipment, and *draglines* when operating on small diameter drums and sheaves.

In addition *only* J&L wire rope is lubricated with BRONZ-LUBE — the lubricant with the high film strength that prevents squeezing out between strands. BRONZ-LUBE contains fine flakes of soft bearing metal providing a smooth wear-resistant bearing surface for every wire—forms close adherent coating that doesn't drip off unless subjected to high temperature.

HERE'S HOW YOU CAN SAVE MONEY ON WIRE ROPE

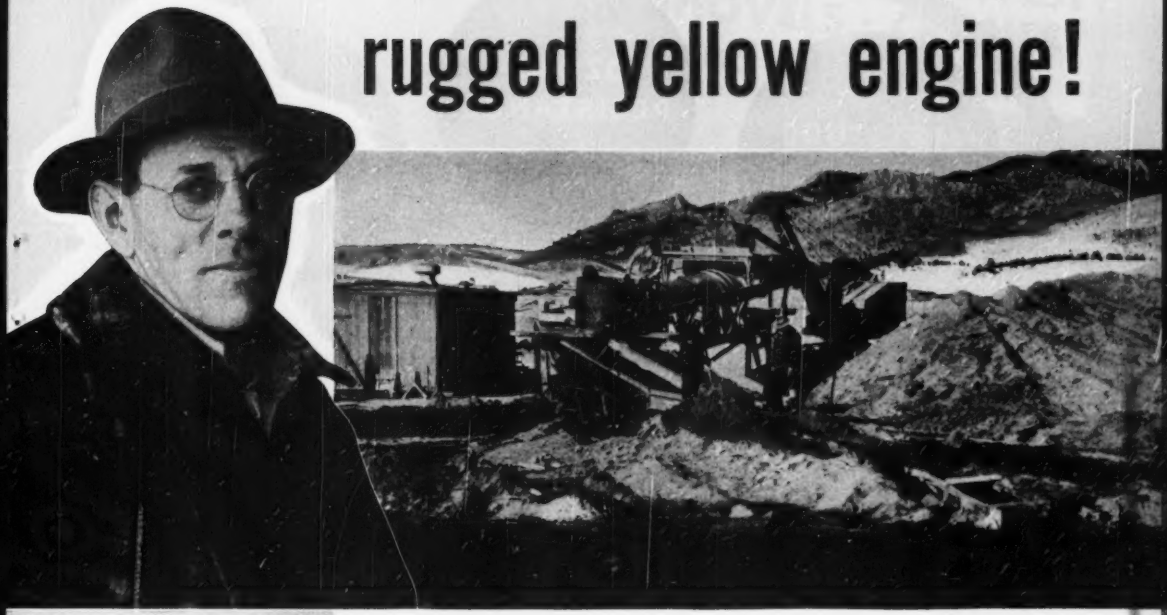
Keep an accurate performance record on your present wire rope on applications mentioned above. When it is worn out, switch to J&L CenterFit and compare its performance with what you are now using. We'll gladly send you a wire rope service card with a plastic holder *free!* Write on your business letterhead to: Jones & Laughlin Steel Corporation, 412 Jones & Laughlin Building, Pittsburgh 30, Pennsylvania.

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L *manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Thar's gold in this rugged yellow engine!



• *This rugged yellow "Cat" D17000 Electric Set helps make mining pay off for the Cripple Creek Mining & Milling Co., Cripple Creek, Colorado.*

DEPENDABLE power is a "must" in places off the beaten track. "Cat" Diesel Engines and Electric Sets give you that—and more! They add to your profits by slashing your operating and maintenance costs. They burn non-premium fuels without fouling. And they deliver steady work day after day, year after year with a minimum of down time.

This "Cat" D17000 Electric Set provides money-making power for the Cripple Creek Mining & Milling Company's washing plant at Gillette, Colorado. Pierce C. Walker, Superintendent, speaks from experience when he says: "I have used more than a dozen 'Cat' units in half a dozen western mining camps. I find they give you better satisfaction than others." The reason? "Cat" Diesels are engineered and built to stand up under the most severe conditions. And they're honestly rated—their advertised horsepower is all *workpower!*

Your "Caterpillar" dealer, too, gives real satisfaction in competent, prompt service that's available day and night seven days a week. No matter how remote your location, you can count on an answer to your call. "Cat" power and "Cat" service can help you make more money on your mining operation.

•

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

LOOK UNDER THE HIDE

"Caterpillar" intake and exhaust valves are made of highly alloyed, heat-resistant steels. Their ample size and close machining and heat-treat specifications have resulted in thousands of hours of trouble-free valve operation. Valve and rocker arm design are matched to reduce wear. Look under the hide for quality. It doesn't show on the outside—it shows up in performance.

CATERPILLAR

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DIESEL ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

NOW...

MOISTURE RESISTANCE

OZONE RESISTANCE

RESISTANCE TO HEAT and AGING

...All Three In One High-Voltage Cable!

Study the facts behind high-voltage cable failures and you'll readily realize just how much moisture resistance, ozone resistance, and resistance to heat and aging mean to high-voltage transmission and distribution systems. Now — for the first time — all three properties are combined in a single insulation, Anhydrex XX — available only in Simplex-ANHYDREX XX Cables.

Aged in an air oven at the grueling temperature of 250 F. (121 C.), Anhydrex XX has proved itself to be far and away your most dependable assurance of low-cost, trouble-free cable operation at the higher voltages. Here's how:

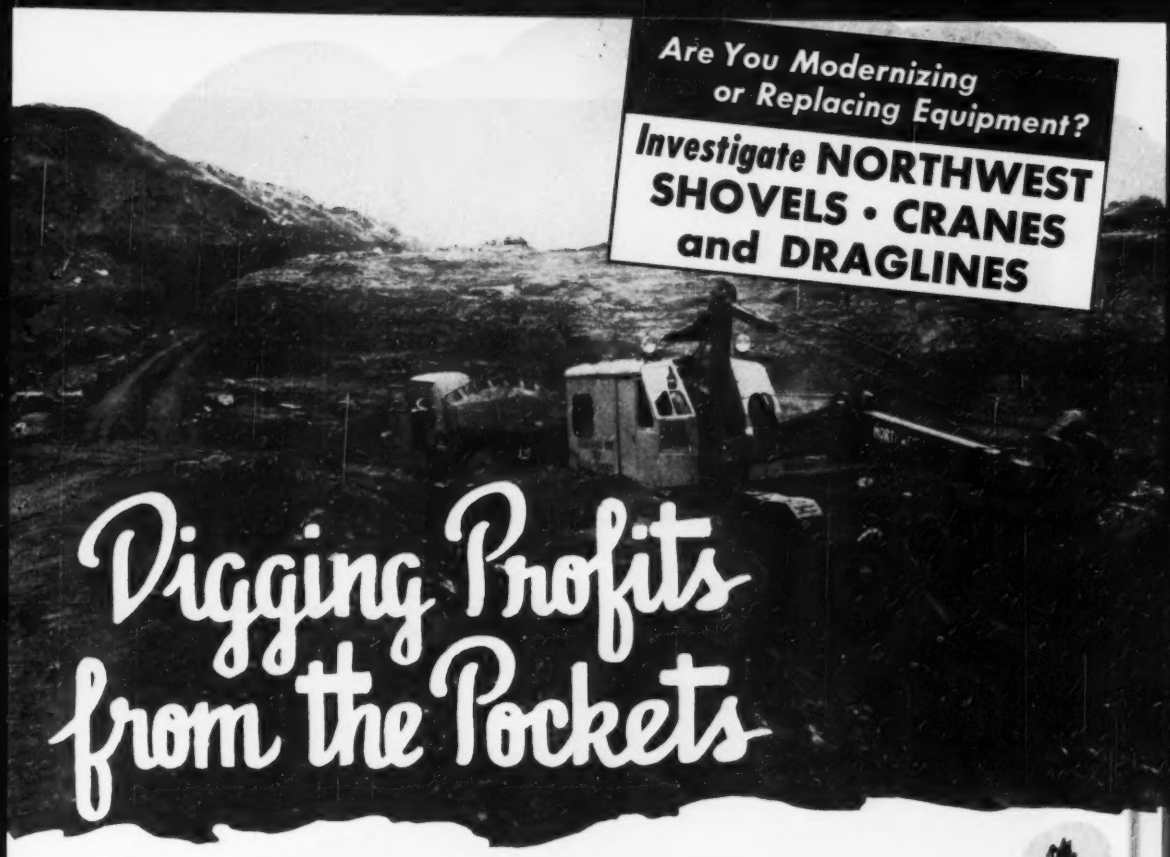
Aged for 16 weeks, it retained approximately 50% of its tensile strength, nearly 68% of its elongation. More than that, its rate of deterioration after the first few weeks was very slight, indicating exceptional stability and long life. It remained rubber-like in quality and appearance and was still suitable for further use. Compare this with ordinary vegetable oil base and heat-resistant compounds which, inside of only 3 weeks, became brittle and cracked and crumbled.

Aged for 7 days, Anhydrex XX was immersed for a week in distilled water at 158 F. (70 C.) and absorbed less than 15 mg. per square inch of exposed surface.

Aged for 7 days, it was bent around a mandrel and exposed to .03% ozone for 4 hours yet would not crack.

Compare these values with those of any other high-voltage insulation. You'll find a big difference; a difference that pays off in more economical, more efficient, and more reliable power transmission whenever Simplex-ANHYDREX XX Cables are on the job. If you would like more complete information and specification data on Anhydrex XX, simply drop us a line at the below address.

SIMPLEX WIRE AND CABLE COMPANY
79 Sidney Street, Cambridge 39, Massachusetts



Are You Modernizing or Replacing Equipment?

Investigate NORTHWEST SHOVELS • CRANES and DRAGLINES

Digging Profits from the Pockets

HERE'S an unusual mining job — a Northwest Pullshovel being used in the iron ore operations on the Range to clean up rich and profitable pockets. This machine gets around easily on the mine floor, cleans out a pocket quickly and moves on to the next, doing a job the big machines pass over.

Northwests have proved themselves in a wide range of mining work.

The standard Northwest Shovel with its hard rock advantages means higher output in any rock digging. The Northwest Dragline is the solution to many overburden jobs. The Northwest Crane answers the material handling problems around the mill — and, if you need your Northwest truck mounted, there is a combination of Truck Crane and Carrier features found in no other rubber tired equipment.

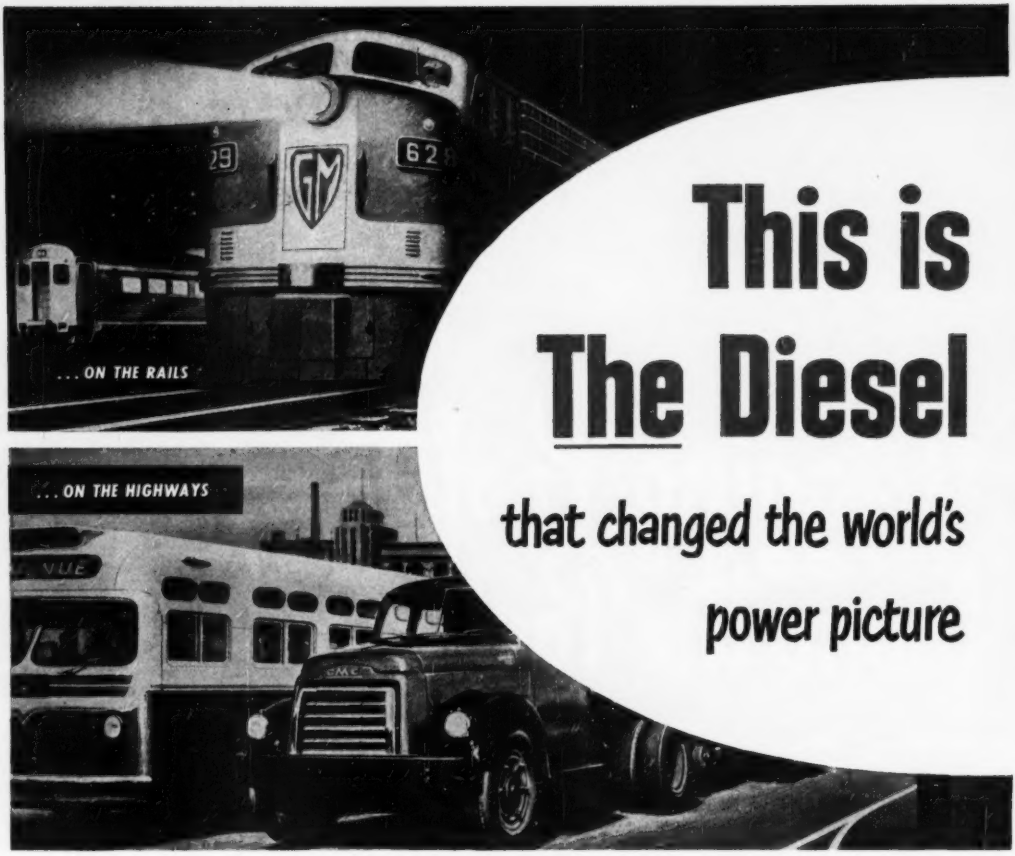
You are planning equipment modernization and changes. Before buying a Shovel, Crane or Dragline, get details on Northwest equipment and what its advantages will mean to you.

NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

Northwest Truck Crane unloading crusher parts.

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem



This is The Diesel

that changed the world's power picture

ONE DIESEL—and one alone—blazed a trail which has won world-wide recognition for the oil-burning engine as the most economical source of smooth, dependable, agile power for locomotives, trucks, buses, marine and other mobile uses.

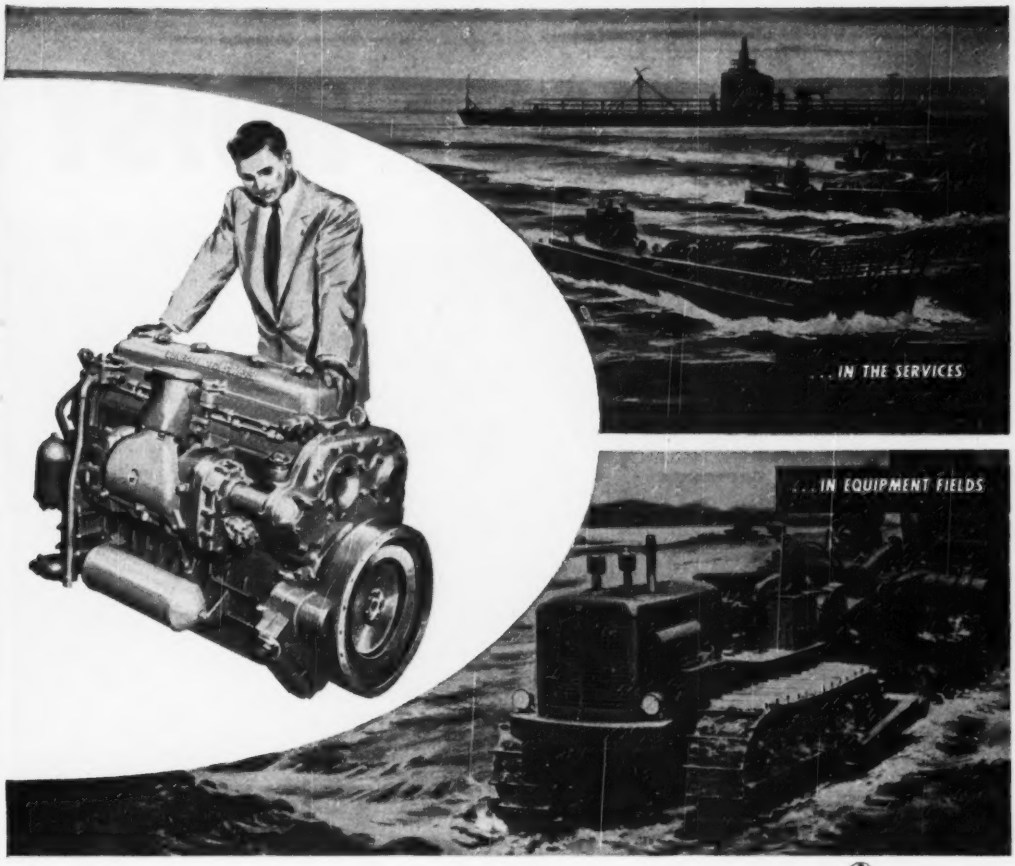
It is the General Motors Diesel engine, one size of which now drives most of America's crack passenger and freight trains. Another powers many of the Navy's submarines and other vessels.

And a third—the GM Series 71 engine—is the most widely used of all, totaling 46,000,000 horsepower. *It has surmounted the exacting conditions of War and met the economic requirements of Peace.* It has brought the same efficiency to a wide range of jobs, including many where Diesel power was never usable before.

That is because the "71," like all GM Diesels, is a two-cycle engine. Two-cycle means it produces power with every piston downstroke—in contrast to most other Diesels that generate power only on every second downstroke.

Equally important, GM Diesels have a direct jet-injection system that feeds fuel to cylinders in exactly metered charges—insuring better combustion and eliminating troublesome high-pressure fuel lines.

These basic differences make GM Diesels far more compact and much lighter than other Diesels of equal horsepower—without sacrificing ruggedness. These engines accelerate faster, are unmatched for smoothness, start quickly and are clean-burning.



"Your Key to Power Economy"

Today, GM Series 71 Diesel engines are taking the place of gasoline engines on many types of power jobs — of steam engines on land and sea — even of other Diesels because twelve years' experience has proved they are so dependable, so efficient, so economical.

General Motors 2-cycle Series 71 engines provide Diesel power at its best — *Diesel brawn without the bulk.*

Hear Henry J. Taylor on the air every MONDAY evening over the ABC Network, coast to coast.

Only GM Diesels provide all these advantages

- Smaller size, less weight per horsepower
- Two-cycle smoothness, power on every downstroke
- Quick starting, on its own fuel
- Unit injectors—no high-pressure fuel lines
- Rapid acceleration • Cleaner-burning
- Better high-altitude performance
- Easy accessibility

GM
GENERAL MOTORS
DIESEL POWER

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES . . . Up to 275 H.P. DETROIT 28, MICHIGAN MULTIPLE UNITS . . . Up to 800 H.P.

GENERAL MOTORS

NO BODY-HOIST

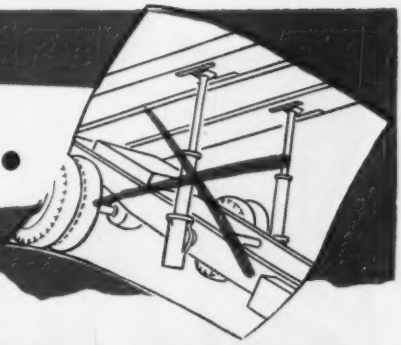
Advanced Gravity Dump saves 15 to 25 seconds over slow-raising body hoists. At 16 trips per hour, 20 seconds dumping time saved each cycle add up to 5.3 minutes, or, 9% more haul-time every hour.

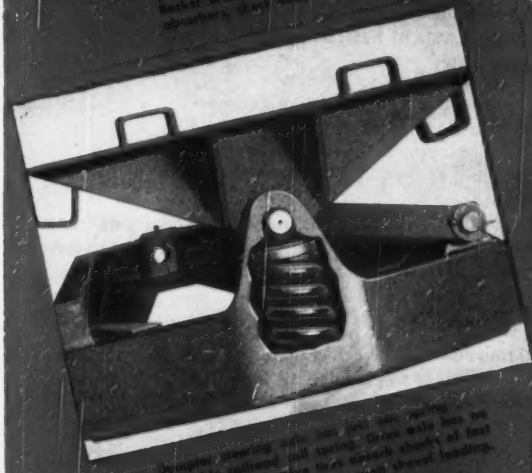
Team DUMPTORS with KOEHRING EXCAVATORS for lowest costs . . .

Koehring's "complete package" of heavy-duty excavators and Dumptors offers you consistent savings on both excavating and hauling. 4 rugged sizes assure top output in every shovel class: ½-yard 205, and ¾-yard 304 (illustrated), available on crawlers or rubber . . . big 1½-yard 605 and 2½-yard 1005. It pays to standardize on Koehring.

KOEHRING HEAVY DUTY

MAINTENANCE....





KOEHRING DUMPTORS

haul more yards per shift at less cost per yard because they have no slow-working body hoists. Operator trips release lever and gravity dumps the load in 1 second. There are no hoist maintenance delays . . . no hoist replacement parts to eat into work-time or profits. Koehring gravity dump is instantaneous and trouble-free in all temperature extremes . . . never balks . . . never wears out.

NO COSTLY SPRING MAINTENANCE...

You also save spring maintenance time and spring replacement costs because heavy-duty Dumptors have only one big double-coil chassis spring, on the steering axle. That's all . . . none on the drive axle. Big, shock-absorbing 16.00 x 24 tires eliminate need for more.

Add up all *your* body hoist and spring maintenance costs for a year . . . see how much you'll save with Koehring heavy-duty Dumptors. Find out, too, how Dumptor's no-turn shuttle haul . . . constant-mesh transmission . . . and 3-speed travel forward and reverse, can increase *your* production and profits. See your local Koehring distributor *today!*

DUMPTOR-Trademark Reg. U. S. Pat. Off. K907

KOEHRING COMPANY
Milwaukee 10, Wis.

SUBSIDIARIES: PARSONS • JOHNSON • KWIK-MIX

Made for each other!

...Like ROCKMASTER Split-Second Detonators and ATLAS Explosives

Like ball and bat, ROCKMASTER split-second detonators and Atlas explosives just naturally *go together!* And fitting like a *glove* with them is the method of loading, tying all together with a *system.*

Gear the *right* choice of these famous Atlas explosives with the *right* combination of the 16 available Rockmaster split-second detonators—add the proper balance of drill pattern and blast-hole loading—and you have the true ROCKMASTER BLASTING SYSTEM. Here's the original split-second delay blasting method . . . the system that has given such outstanding results in terms of better breakage, better control over throw, and minimum noise and vibration.

What you want to accomplish on a particular job controls the choice of detonators, the drill pattern, and which of these well-known Atlas explosives is best suited to the job:

GIANT GELATINS
For all but the most severe water conditions. High strength per pound—shattering action.

GELODYNS
Exceptionally economical to use where water conditions are not severe.

ATLAS EXTRA DYNAMITES
Excellent all-purpose explosive for outdoor work.

AMODYNS
High cartridge count, economical explosives for comparatively dry conditions.

APEX
Especially formulated and packed for quarrying and stripping. Excellent for large-diameter blast holes under most conditions. Available in 8 strengths—low, medium or high velocity.

COALITES
Permissible explosives. Available in variety of strengths and velocities to give desired lump sizes under widely different conditions.

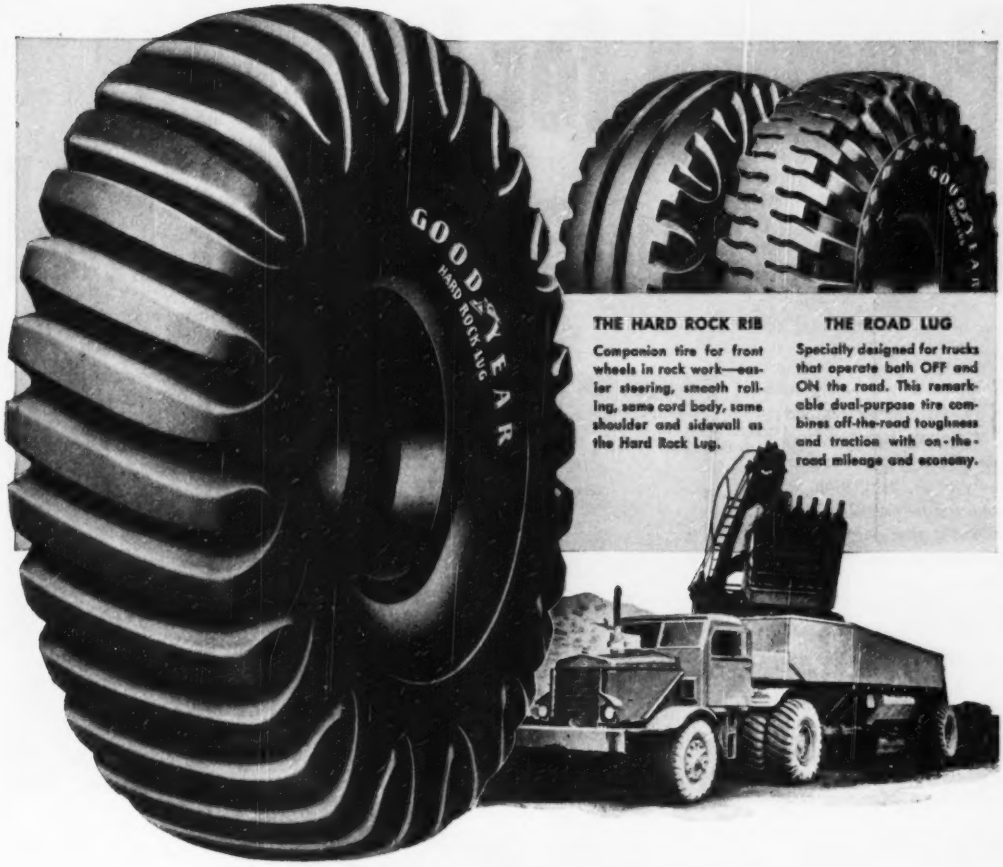
Your Atlas representative will be glad to show you how these and other Atlas developments will help give you top explosives performance. Write for Atlas Explosives Catalog and ROCKMASTER *"16" booklet.*

ROCKMASTER, GELODYN, AMODYN, APEX, COALITE Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington, Del. • *Offices in principal cities* • *Cable Address—Atpowco*


GOODYEAR
HARD ROCK LUG
THE HARD ROCK RIB
Companion tire for front wheels in rock work—easier steering, smooth rolling, same cord body, same shoulder and sidewall as the Hard Rock Lug.
THE ROAD LUG
Specially designed for trucks that operate both OFF and ON the road. This remarkable dual-purpose tire combines off-the-road toughness and traction with on-the-road mileage and economy.

for ruggedness, long life, economy

—use the HARD ROCK LUG—your best buy for all types of rock work

BIG, tough and really rugged, Goodyear's famous Hard Rock Lug is sure to cut your hauling costs. The Hard Rock Lug is job-designed, specially built with an extra-thick undertread to protect its extra-tough carcass from damaging bruises—tread and sidewalls are armored by big husky lug bars as protection against cuts and rips—its self-cleaning tread rates tops in its class for traction.

Get premium performance and rock-bottom economy for your tire dollar with Goodyear's Hard Rock Lug. Remember, always BUY and SPECIFY Goodyear—*it pays!*

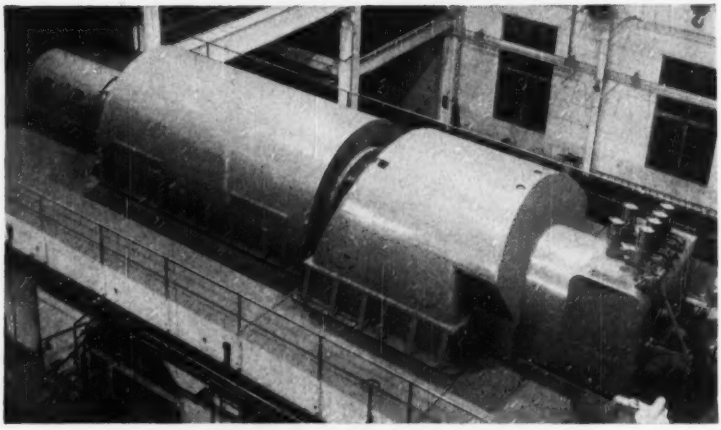
GOODYEAR

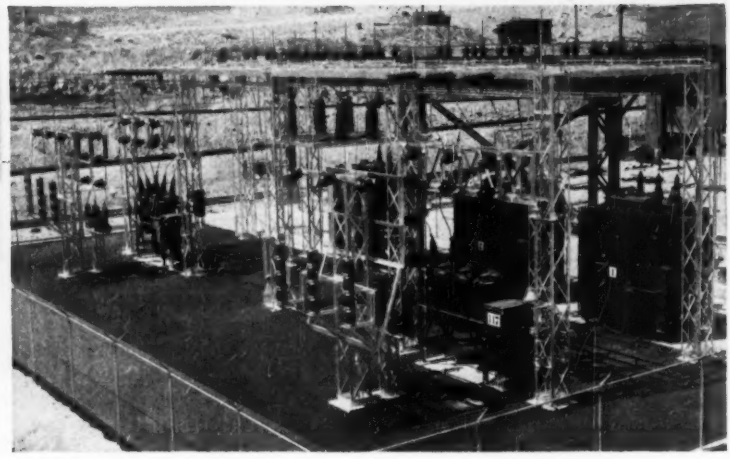
Road Lug—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND

Powered for low-cost high-tonnage refining!

1 Typical of the mining industry's increasing electrification to handle high tonnages at low cost is this new copper refinery at Garfield, Utah, which has a capacity of 12,000 tons of refined copper per month, with provision for expansion to 16,000 tons. Power for the refinery and other operations comes from Kennecott's power station, where three G-E steam turbine-generators (two of 25,000 kw each, plus the 50,000-kw unit shown here) generate 13.8-kv power which is stepped up to 44 kv for transmission.

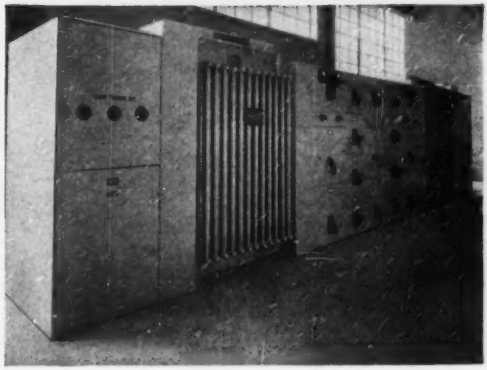


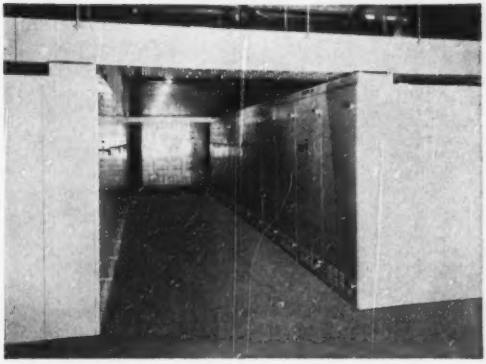


2 At the refinery, three miles away from the power plant, incoming 44-kv power is stepped down to 13.8 kv at this G-E package substation. Completely co-ordinated, it includes an outdoor steel switching structure, three 7500/9375-kva power transformers (with provision for addition of a fourth) and necessary metal-clad switchgear. G-E package substations, made in many standard combinations to fit all mining-industry needs, come in factory-built sections ready to install. They simplify ordering, save engineering time, speed installation, cut costs.

GENERAL ELECTRIC

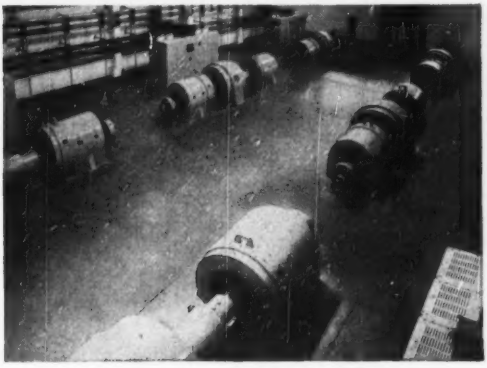
In its new electrolytic refinery, Kennecott Copper Corporation uses this General Electric generation, conversion, and distribution equipment to help maintain production continuity





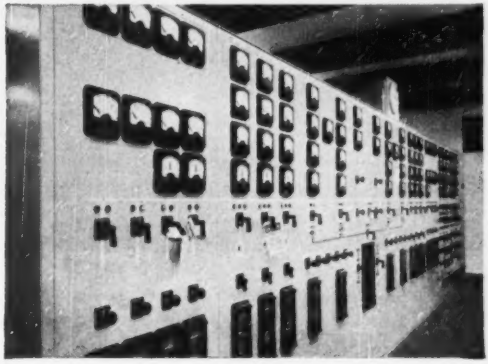
3 Inside the refinery, protecting all 13.8-kv feeders and personnel as well, is this G-E metal-clad switchgear that provides flexibility for future load changes.

4 A-c is converted to d-c for electrolytic cell lines by six G-E motor-generator sets, each including a 2900-hp synchronous motor and two 1000-kw, 125-volt d-c generators.



5 Four G-E 1500-kva double ended load-center substations (one shown) step down voltage from 13,800 to 480 and provide distribution at centers of load to reduce power losses.

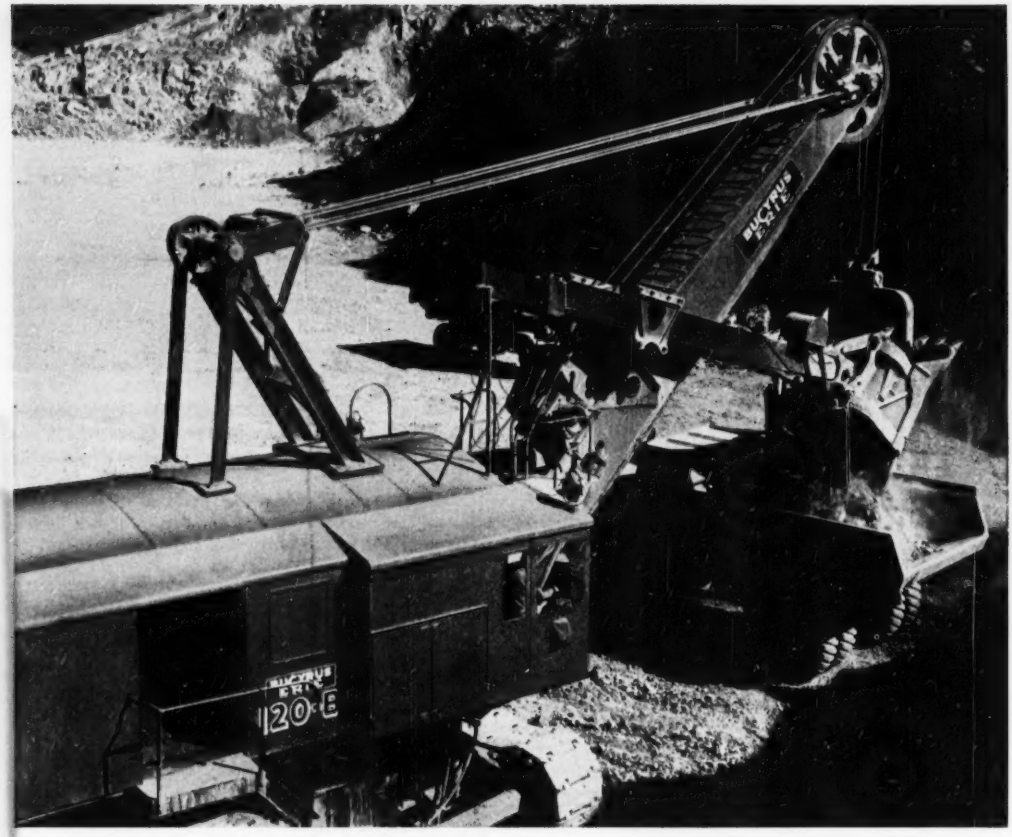
6 This G-E panel — controlling package substation, a-c switchgear, and d-c power for electrolytic cell lines — helps centralize and co-ordinate plant operations.



CO-ORDINATED POWER SYSTEMS

for the Mining Industry

Whatever *your* mining or processing problem, a good man to know is the mining industry specialist in your nearby G-E office. Ask him about power-system equipment for *your* plant to protect service continuity, help boost production, cut costs. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Seven Keys to OUTPUT

Here are seven good reasons why Bucyrus-Erie's 3-cubic yard 120-B gives you big output at low cost:

1 PERFECT CONTROL — Responsive Ward-Leonard variable voltage control makes it easy for the operator to maintain a fast, productive pace throughout the shift.

2 BALANCED DESIGN — Efficient weight placement and balanced speeds and power mean smooth operating action . . . there's no excess weight anywhere to slow cycle time.

3 DIGGING FORCE — Maximum effective digging force is applied to dipper teeth because long upper boom section, big sheaves and single-part hoist give wide angle between line of bail pull and line of backward thrust.

4 WIDE RANGE — 120-B's long range and high lift make it possible to handle wide cuts efficiently, with minimum time lost in moving or loading.

5 FAST SWING — Full-revolving 120-B has twin vertical swing units providing fast acceleration and deceleration for a smooth, speedy swing that steps up output.

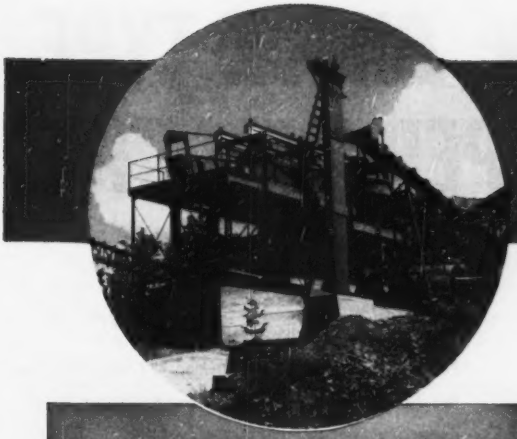
6 MANEUVERABILITY — Strong, flexible 120-B mounting provides a firm digging foundation, permits quick moves anywhere in the pit.

7 "YEARS AHEAD" ENGINEERING — The 120-B is designed for years of outstanding service under hard working conditions. Built of carefully selected steels and alloys for strength and durability, 120-B design embodies unequalled world-wide experience in the manufacture of excavating machinery.

BUCYRUS ERIE

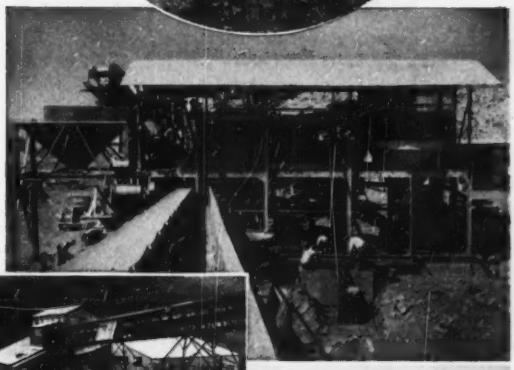
SOUTH MILWAUKEE, WISCONSIN

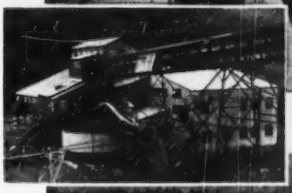
73L49



15 MILLION TONS ANNUALLY!

WITH 36 WEMCO MOBIL-MILLS





INDUSTRY-WIDE ACCEPTANCE of the WEMCO MOBIL-MILL is demonstrated by this outstanding record of use (*average rated capacity) by operators in both the metallic and non-metallic mining fields. The success of these prefabricated heavy media plants is the result of five important advantages:

- ***PREFABRICATION*** — *furnished complete, ready to install*
- ***INSTALLED FOR YOU*** — *by skilled WEMCO field crews*
- ***LOW COST*** — *both initial cost per ton capacity and operating costs are low*
- ***CLEAN SEPARATION — HIGH RECOVERY*** — *due to accurate easily controlled HMS process*
- ***WIDE APPLICATION*** — *due to amenability of HMS to a wide variety of ores*

VERSATILITY of the Mobil-Mill is demonstrated by its efficiency in milling a wide variety of minerals, including:

GALENA	BROWN IRON ORES
BARITE	BASE METALLICS
HEMATITE	ANTHRACITE COAL
FLOURSPAR	BITUMINOUS COAL
GRAVEL	SPODUMENE
LEAD, ZINC SEMI-SULPHIDES	DIAMONDS

WEMCO MOBIL-MILLS may be rented or purchased in several sizes to treat from 5 to 275 T. P. H. feed. Design flexibility and the use of either cone or drum type separator make possible a Mobil-Mill to fit your special requirements at no extra cost.

WRITE TODAY *for information on the application of Mobil-Mills to your milling needs.*

WEMCO

WESTERN MACHINERY COMPANY

760-766 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

WKE (HMS) Mobil-Mill • Coal Spiral • Standard Thickeners (HMS) Thickeners • (HMS) Media Pumps • Hydroseparators (HMS) Densifiers • (HMS) Separatory Cones • "SH" Classifiers Sand Pumps • Conditioners and Agitators • Fagergren Flotation Machines • Dewatering Spirals • (HMS) Laboratory Units

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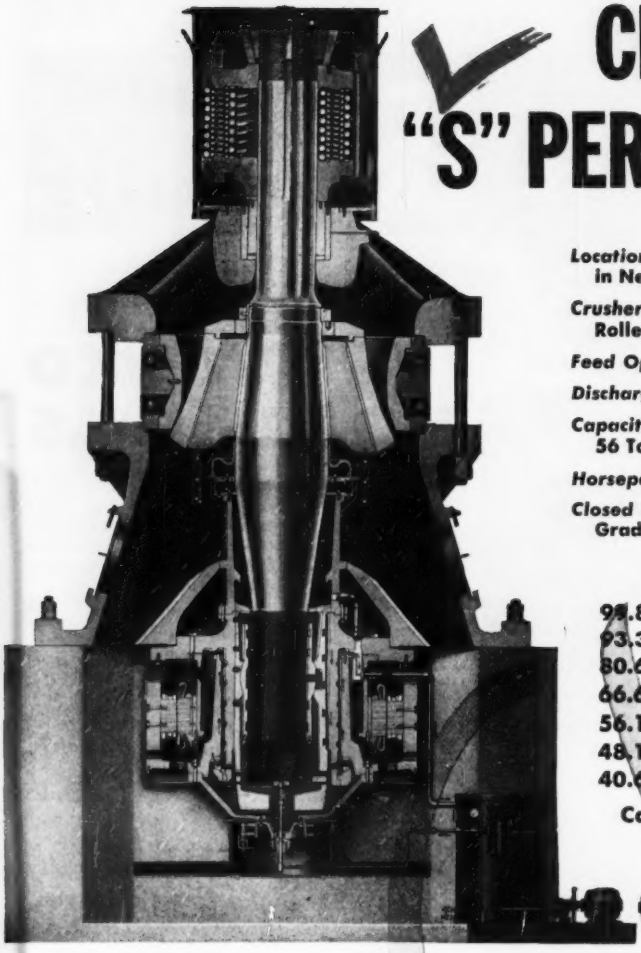


CHECK TYPE "S" PERFORMANCE

Location: **Nationally known Mining Co. in New York State**

Crushers: **Four No. 37½ Kennedy type "S" Roller Bearing Gyratory Crushers**

Feed Opening: **6¼"; Diameter of Head: 3 Feet**

Discharge Setting: **7/32" Closed Side at Head**

Capacity Each Crusher: **56 Tons Per Hour**

Horsepower Each Crusher: **48 HP.**

Closed Circuit Operation: **Gradation As Follows:**

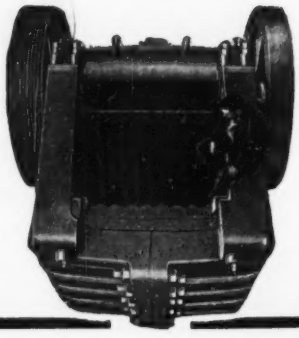
CHECK THE FIGURES!

98.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

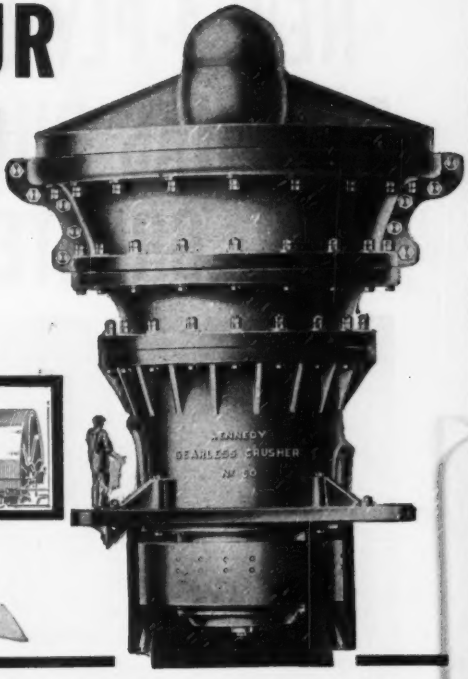
Can You Equal These Figures?

CHECK SWING JAW CONSTRUCTION

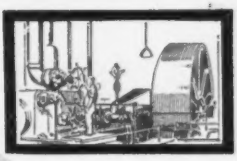
We checked POWER-LOSS in the "KVS" Swing Jaw Crusher. How? By making the STATIONARY jaw carry 50% of the crushing load, instead of leaving it all to the SWING jaw. Result—you SAVE POWER in crushing. Another thing we checked is PARTS TROUBLE, by making the swing jaw ALL IN ONE PIECE, except for the crushing plate. And we made that removable. Note also —Swing and Stationary jaws are INTERCHANGEABLE, and reversible end for end. This means DOUBLE jaw-crushing life. CHECK!



✓ CHECK YOUR KINETIC ENERGY

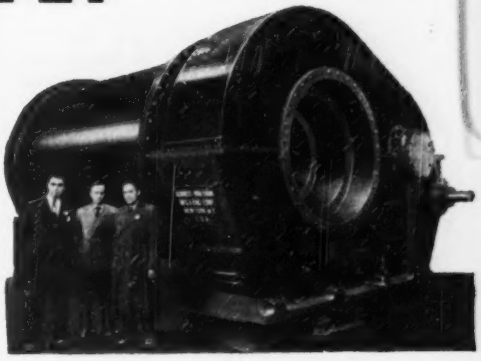


Ever check an old Corliss Engine and see how the big whirling flywheel or pulley developed KINETIC ENERGY (or, in simple words, added FREE power)? There's a BIG Pulley in the "KVS" Gearless, too! It revolves at a speed of 3,500 ft. per minute — that's what creates the EXTRA crushing power you get for nothing! What's more, the 11 ton pulley (used in a "KVS" Gearless Crusher weighing 400,000 lbs.) turns so easily you can turn it with TWO FINGERS! In short, more CRUSHING for LESS POWER COST (with much less vibration and much less NOISE), is the idea that put the "KVS" Gearless way out in front and keeps it there! And there are many other features . . . Check!



✓ CHECK THE FAT CHECK YOU WILL SAVE!

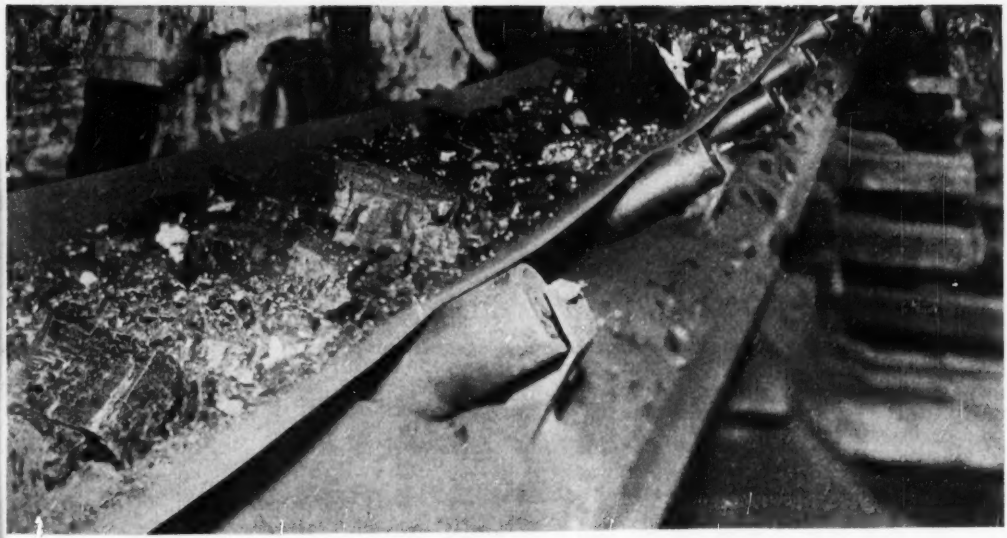
How'd you like to tear up your check for, say, $6,000 that you thought you'd have to spend on a 10 ft. tube or ball mill? Well — you can do just that if it is a "KVS" Mill with integral gear drive. With this drive, you can use a SYNCHRONOUS MOTOR, at a TREMENDOUS saving! Why? Because motor is DIRECT CONNECTED to driving shaft. Shaft is carried in roller bearings that CANNOT be misaligned or set wrong. The pinion shaft to which the motor is connected runs at approximately 600 r.p.m. while pinion shafts in other mills run at about 180 r.p.m. Another thing . . . "KVS" trunnions on large sized tube and ball mills are CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings automatically sprayed with oil before tube mill is started (Design patented). In 15 years no "KVS" gears or pinions have worn out on this type mill. Check!



There are "KVS" BULLETINS covering all the above. Write for them today.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVE., NEW YORK 16, N. Y.
FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA

NEW 4-PLY UNDERGROUND COAL BELT HAS RUGGED STRENGTH AND GREATER FLEXIBILITY



Here's the remarkable new 4-ply U. S. Giant Underground Coal Belt utilizing a combination of cotton and nylon that's every bit as rugged as United States Rubber's 4-ply 42 oz., but with greater crosswise flexibility.

This belt is available in two styles:

Style XN has a working tension strong enough to handle all known belt requirements except extremely long center installations.

Style YN incorporates the additional strength required by extremely long center installations in use or planned.

Outstanding features of this remarkable belt include: OPTIMUM CROSSWISE FLEXIBILITY, providing excellent troughing and easy training, eliminating edge wear and spillage. CROSSWISE STRENGTH, to resist gouging and tearing. ONE-TYPE FABRIC CONSTRUCTION, to equalize tension and elongation throughout the belt. ELASTICITY, to cushion shock loads and impact, prevent localized strain. FASTENER HOLDING STRENGTH comparable to United States Rubber Company's 4-ply 42 oz., which hitherto has been considered outstanding in this respect. HIGH STRENGTH AT LESS WEIGHT facilitates transportation of belt in underground locations. Up to 2¼ times more strength at no increase in weight over conventional constructions.

For more information, write Mechanical Goods Division, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

A PRODUCT OF

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

Mechanical Goods Division • Rockefeller Center, New York 20, N. Y.

Today it's Roebling!

Why men who watch costs... specify Roebling Preformed

THE RECORDS PROVE IT... that Roebling Preformed "Blue Center" Wire Rope stays on the job longer and cuts your costs. This is partly because "Blue Center" steel—developed and made only by Roebling—has unsurpassed resistance to abrasion, shock and fatigue. In large measure, too, it is because of the painstaking care, special techniques and modern precision machines that guard and maintain Roebling quality leadership.

Preformed a big help, too. Wide experience in the field proves that Roebling *Preforming* brings still more operating economies. Preformed is easier and faster to handle and install. You can cut it without seizing. It winds better... is not apt to set or kink... minimizes vibration and whipping.

Today's best buy. Roebling makes wire rope of every construction, grade and size ... engineered for top efficiency on every type and make of rope-rigged equipment. Have your Roebling Field Man recommend the *right* rope for best, low-cost performance on each installation. John A. Roebling's Sons Company, Trenton 2, N. J.

In strip mining, for shovel hoist and draglines, Roebling Preformed "Blue Center" Wire Rope with Independent Wire Rope Core is outstanding for small and medium size equipment . . . often preferred for 20- to 40-yard machines.

ROEBLING

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Avenue S.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol Red Engine Oils X

UNIT Industrial bearings—sawmill

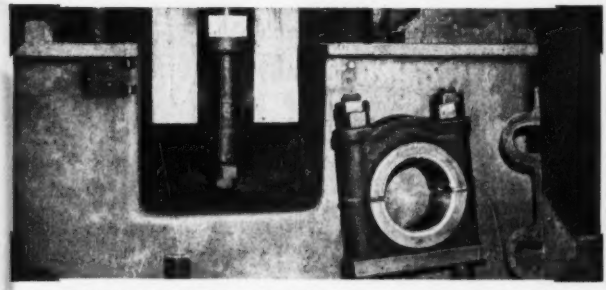
LUBRICATOR All types of oilers

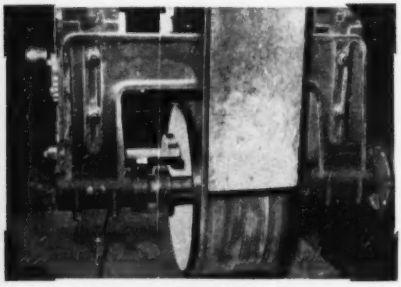
CONDITIONS High pressures + temp.—Intermittent loads

PERIOD 1½ years

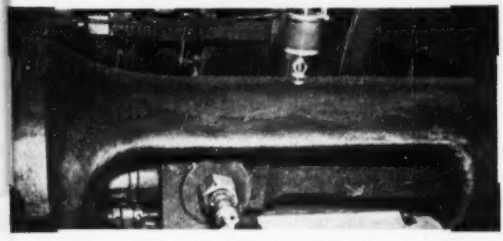
FIRM Darrington Mill, Inc., Darrington, Wash.

Bearing maintenance cut 50 per cent!





COMPOUNDED RED ENGINE OIL 26X in sash gang-saw con-rod bearings (above), arbor bearings (right) and other industrial bearings, practically eliminated wear adjustments, materially reduced leakage and consumption. Mr. Ed Doran of Darrington Mill, Inc., reported, "CALOL Red Engine Oils used for past 18 months...records indicate a 30% saving over straight mineral oil. At end of season less bearing wear was noted, replacements and rebabbiting of bearings was reduced 50%."



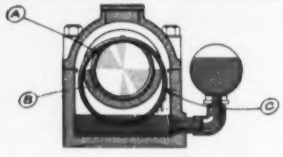
IN A HORIZONTAL STEAM ENGINE, CALOL Red Engine Oils X reduced main bearing temperatures 22° F. They adhere to surfaces and provide lubrication in the presence of water. Note the emulsion formed by condensate leaking through piston rod packing.

REMARKS: CALOL Red Engine Oils X meet all the requirements of plain bearings working in heavy-duty service. Their ability to "carry over" on ring-oilers and bearings and stay on surfaces reduces the friction and starting torque; decreases power required to operate industrial machinery. They come in several grades to meet various operating conditions.

CALOL

TRADEMARK "CALOL" REG. U.S. PAT. OFF.

How CALOL Red Engine Oils X cut industrial lubrication costs



A. Contain special compounds—oil adheres to bearings and moving parts—assures lubrication, prevents leakage, waste, oily floors and resulting fire hazard.

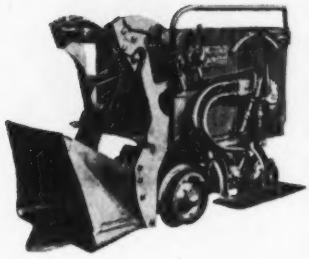
B. Provides tough "oilskin" film that resists heavy loads, high temperatures and prevents wear.

C. Picks up easily on ring oilers...may be applied by all types of oiling systems.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado

Scots use thrifty Eimcos



Model 21 RockerShovel
Loads 2 to 3 tons per minute

Tunnels for Scotland's new hydroelectric projects are loaded out with Eimco RockerShovels. The Scots, known for their thriftiness have chosen Eimco equipment because it is the most economical in loading. Eimco's are not only lower in maintenance costs (per ton loaded)—they're lower in air consumption.

Eimco's are safer to operate too. Every machine has 15 different safety features, built in, to protect the operator from injury on the job.

Write for more information—the Scots say "Ya canna beat an Eimco."

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES SALT LAKE CITY 8, UTAH, U. S. A.

A261

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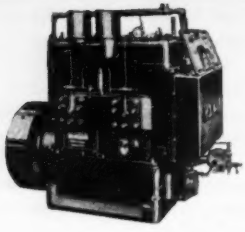
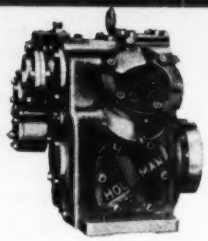
AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN), LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

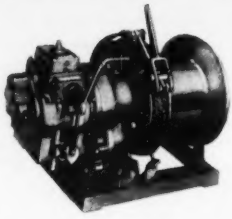
Holman labour-saving machines



STATIONARY COMPRESSORS. Two-stage. Displacements from 80 to 612 cu. ft.

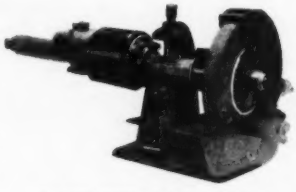


VEE ENGINES. Robust, compressed-air-operated power units for driving conveyors, etc. Reversing and non-reversing models.



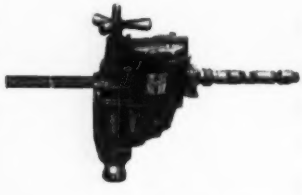
AIR WINCHES. Portable, light and economical for hoisting or hauling. Lifting capacities from 1,400 lb. to 3,000 lb.

ROTOFEED DRIFTERS. Lightweight motor fitted to Drifter eliminates hand cranking. Drilling speed is retained and rapid retraction reduces time taken to drill a round.



No. 4 WET ROTOGRIND — with Bench Mounting consisting of vice, adjustable water trough and wheel guard. Modified machine available for silicon carbide wheels for regrinding tungsten carbide tipped bits.

ROTOPUMPS. A sturdy compressed-air operated pump for dealing with water, oil or fairly heavy sludge. Vane-type air motor with automatic governor.



ROTODRILLS. For drilling, reaming and tapping. Types include all sizes of reversing and non-reversing screw-feed drills, hand-held drills and woodborers.

CHIPPERS AND RIVETERS. Speed-sensitive throttle ensures exact control. Vibrationless, economical and speedy. Models to suit all purposes.

PICKS AND ROAD RIPPERS. High power with low air consumption. Types and sizes for all classes of work.

Holman compressed-air plant and tools do their job year after year, giving longer and better service thanks to the efficient Holman after-sales organisation. There are always new and better Holman machines coming into service, and the complete range covers every industry in which compressed-air power is used. Every engineer will find it most helpful to receive details of new Holman products regularly. Are you on our mailing list?

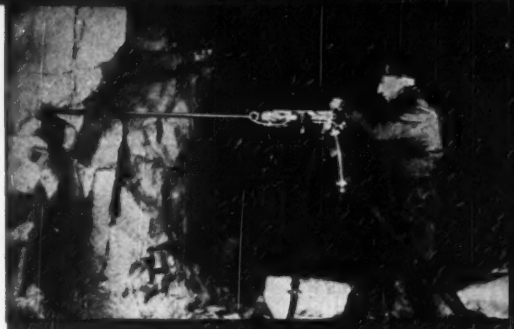
THE HOLMAN COMBINATION

ALLOWS ONE MAN TO DRILL HOLES ANYWHERE —WITHOUT RIGS

The Handril-Airleg-Holbit Combination, **first introduced in Canada in October 1947,** lightens the face-worker's job almost beyond belief. It cuts out all the business of shouldering the drill or rigging and removing columns. All the operator has to do is guide the machine—it does the rest. It drills a deep parallel hole in a few minutes—without needing a steel change. And the operator can go on drilling hole after hole without trouble. The Holman Combination can be set to work almost anywhere—in cramped corners or on the top of débris—and it does its job equally well at floor level or well above the user's head. In collieries and mines all over the world this versatile labor-saver is increasing output and saving manpower and money.

HOLBITS. Tipped with **Wickaloy** Tungsten Carbide—**Made in Gt. Britain and Canada.** Drills holes without "tapering," reduces steel changes and steps up drilling speeds. In three grades and various sizes.

AIRLEG. Lightweight air-feed mounting. Gives full support, feeds at uniform pressure and absorbs recoil. Accommodates most of the Handrils in the Holman range.



This man knows what his wire rope costs him

He's quit guessing. Now he knows what his wire rope *actually* costs. He learned long ago that purchase price alone doesn't tell him a thing. So he devised a simple system of records—records that show the amount of work his ropes do, and their cost per unit of work.

This is something that Bethlehem has always recommended. To get a true picture of rope costs—an accurate picture—you should have figures showing the cost per ton-mile, yard of rock moved, or other unit that best applies to your business.

The keeping of such records is good, sound practice. Gives you a chance to compare rope values. That we like—for we're always ready to stack the Bethlehem product against all comers. You'll be, too—when you use this rope consistently.

BETHLEHEM WIRE ROPE

LET YOUR RECORDS TELL YOU!

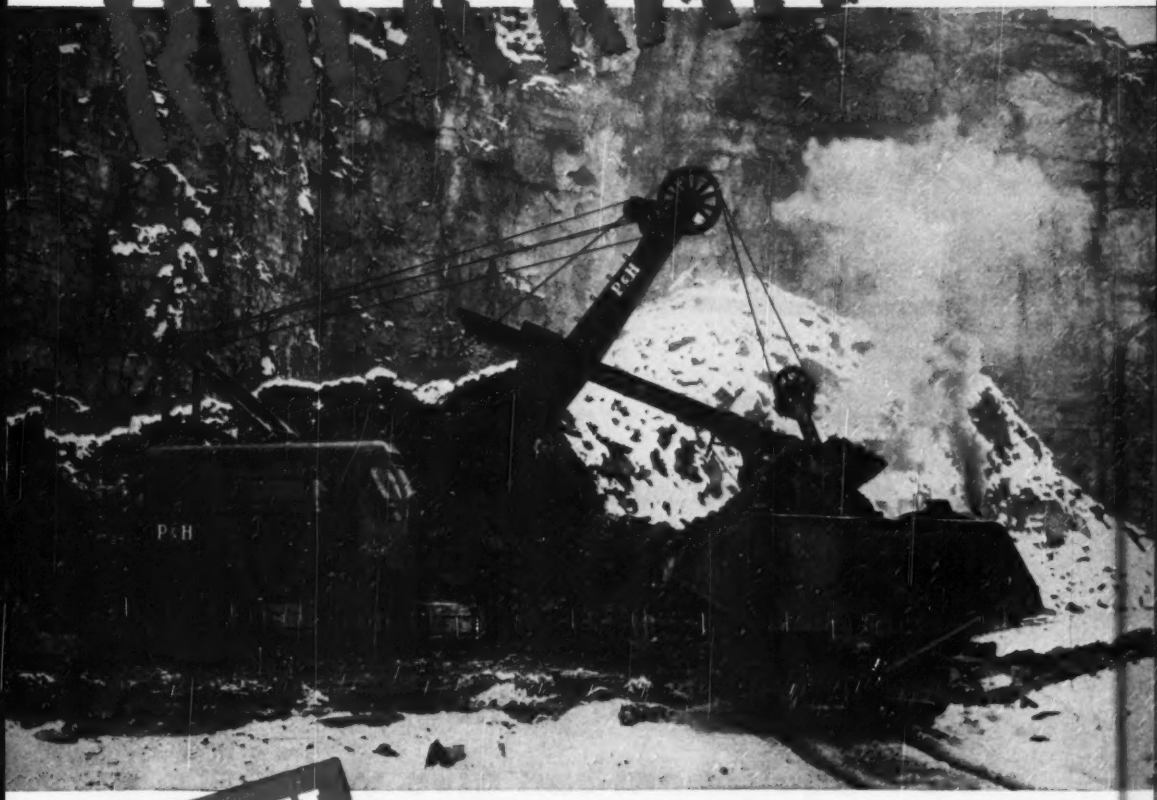
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

ROCK RATED!



THE NEW P&H MODEL 955-A (2½ YDS.)

with *MAGNETORQUE** swing

Watch this new machine get its teeth into a rock job and see what "rock-rated" really means to you. It's *designed* . . . every inch from boom point to crawler shoes . . . to make rock handling easier . . . more profitable for you.

Unbeatable—point for point

P&H Magnetorque eliminates swing friction clutches . . . their troubles and replacement costs. It gives you smoother, faster swings . . . for the life of your machine.

Greater Stability gives you more power at the tooth point . . . and greater work capacity.

Direct Acting Hydraulic Control . . . easier on machine, easier on operator . . . smoother and greater holding power through full wrap brakes and clutches.

*Trade-Mark of Harnischfeger Corporation for electro-magnetic type clutch.

P&H Rapid Reversing Planetary Chain Crowd gives you snappier dipper action. It's more accurate. And crowd chain outlasts 25 to 30 crowd cables.

Get the facts about P&H all-welded strength and Added Values! The 955A is a 2½ yd. version of the P&H 1055 (3 yd. shovel) . . . the machine that has set new, low-cost production records everywhere. Write for Bulletin X122, today.

P&H EXCAVATORS
4454 West National Ave.
Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS and ELECTRODES • SOIL STABILIZERS • CRAWLER and TRUCK CRANES • DIESEL ENGINES • CANE LOADERS • PRE-ASSEMBLED HOMES

JOY MACHINES

Field-Proved in Service

Made by the world's largest manufacturer of Underground Mining Equipment, and the pioneer in mechanized mining, JOY Equipment can give you the great advantage of

MORE PRODUCTION AT LESS COST

The JOY Line is COMPLETE

Note, in the comparison below, how JOY EQUIPMENT stands out in its ability to take care of Metal Mine Requirements

	JOY	Company B	Company C	Company D	Company E	Company F	Company G	Company H
ROCK DRILLS								
Spaders						NO		
Busters						NO		
Jack Hammers						NO		
Stopers						NO		
Drifters						NO		
Drill Jibs					NO	NO	NO	
Drill Jumbo (Track)			NO	NO	NO	NO	NO	
Drill Jumbo (Trackless)		NO	NO	NO	NO	NO	NO	NO
DRILL BITS								
Carbide Bits			NO	NO	NO	NO	NO	NO
Detachable Bits	NO		NO	NO	NO	NO	NO	NO
Thro-Way Bits		NO	NO	NO	NO	NO	NO	NO
HOISTS								
Single Drum Utility					NO	NO	NO	NO
Single and Two Drum Shaft		NO	NO	NO	NO	NO	NO	NO
Two Drum to 15 HP				NO	NO	NO	NO	NO
Two Drum to 125 HP			NO	NO	NO	NO	NO	NO
Three Drum to 15 HP				NO	NO	NO	NO	NO
Three Drum to 125 HP			NO	NO	NO	NO	NO	NO
Sheaves		NO	NO	NO	NO	NO	NO	NO
CORE DRILLS								
Blast Hole			NO		NO	NO	NO	NO
Exploratory			NO		NO	NO	NO	NO
COMPRESSORS								
Portable						NO	NO	
Vertical—Air Cooled						NO	NO	
Vertical—Water Cooled						NO	NO	NO
Large Heavy Duty						NO	NO	NO
LOADERS								
Scraper Slides			NO	NO	NO	NO	NO	NO
Mine Car Type		NO		NO	NO		NO	NO
Trackless Loaders (Medium)		NO	NO	NO	NO		NO	NO
Trackless Loaders (Heavy)		NO	NO	NO	NO	NO	NO	NO
MATERIAL HANDLING								
Shuttle Cars		NO	NO	NO	NO	NO	NO	NO
Chain Conveyors		NO	NO	NO	NO	NO	NO	NO
Shaker Conveyors		NO	NO	NO	NO	NO	NO	NO
Belt Conveyors		NO	NO	NO	NO	NO	NO	NO
MINE VENTILATION								
Portable Blowers, Electric		NO	NO	NO	NO	NO	NO	NO
Portable Blowers, Air		NO	NO	NO	NO	NO	NO	NO
Large Mine Fans		NO	NO	NO	NO	NO	NO	NO

WRITE FOR BULLETINS, OR *Consult a Joy Engineer*

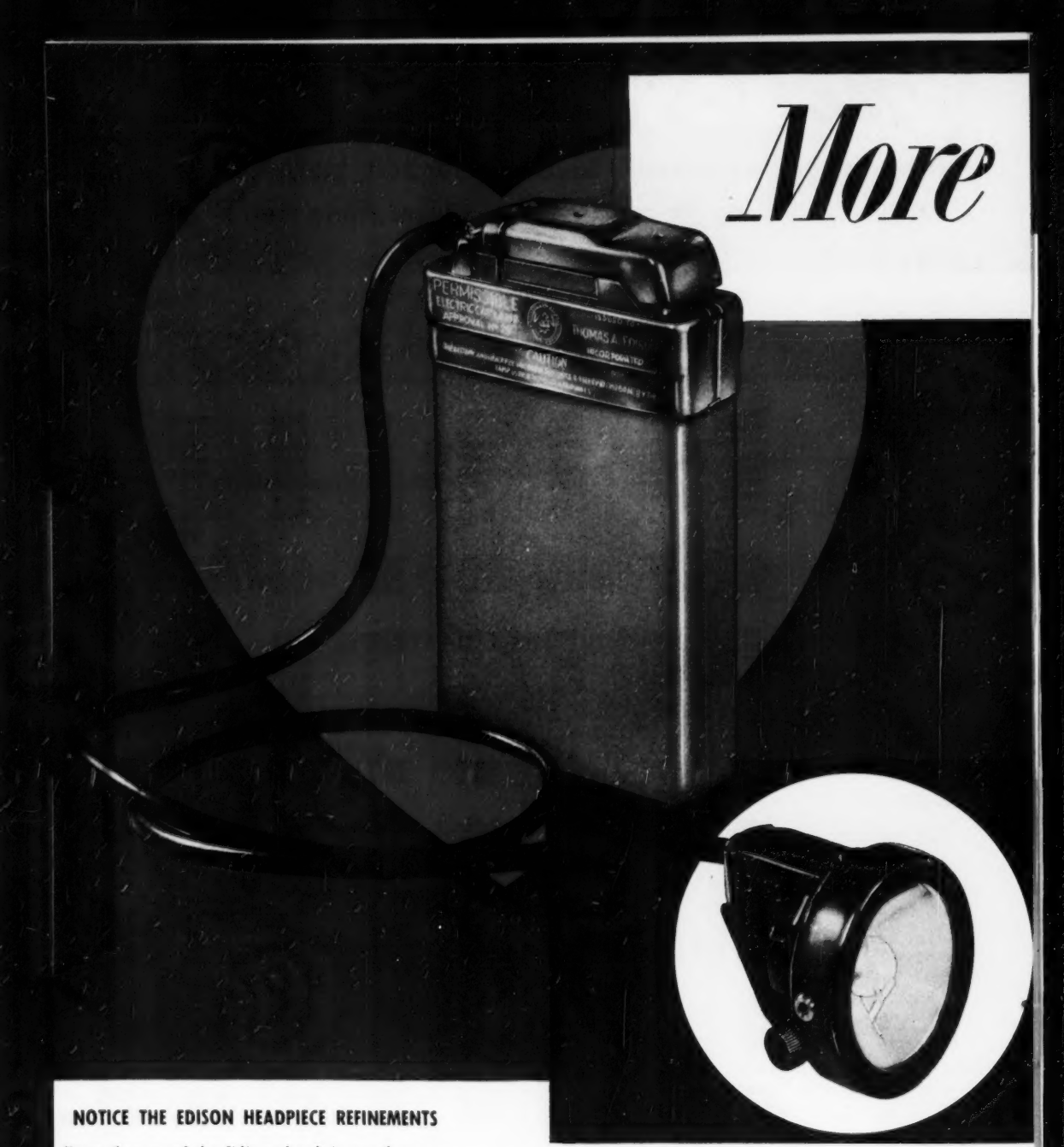
W&D M2572

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

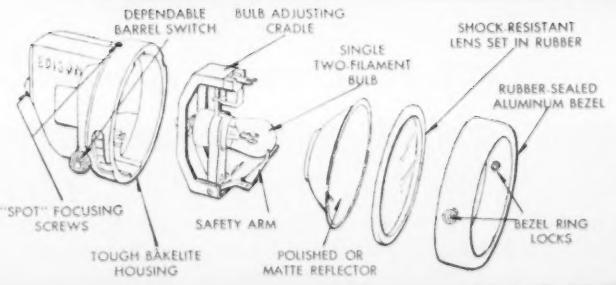
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

More



NOTICE THE EDISON HEADPIECE REFINEMENTS

Every feature of the Edison headpiece reflects superior design engineering for better service. Headpiece is easily adapted for strong "spot" or flood beam. Simple 2-screw adjustment of spot without disassembly enables perfect focus always. The single gas-filled bulb has two filaments of equal rating, so that effective working light is always available by a turn of the barrel-switch that operates both filaments. Quick removal and re-assembly of the reflector, bulb or rubber-cushioned lens is easy as the positive bezel-locking ring requires only a ⅛ turn—no threads. Write for descriptive bulletin.



Effective Light

BETTER DIRECTED TO THE JOB!

Edison MODEL R-4 ELECTRIC CAP LAMP

U. S. Bureau of Mines Approval No. 29

The Edison Model R-4 Electric Cap Lamp *does* more because it *has* more! This most essential tool of the miner increases tonnage with more light and better light . . . more convenience in use, complete dependability, and lower maintenance.

Let us arrange a demonstration—and give you the facts, too, on lower handling costs!

- PIERCING, LONG-RANGE SPOT OR FLOODLIGHT BEAM
- POSITIVE SPOT ADJUSTMENT
- BALANCED HEADPIECE
- SINGLE BULB WITH TWIN FILAMENTS
- STURDY CONSTRUCTION

MSA
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS . . . . . PITTSBURGH 8, PA.

At Your Service: 48 BRANCH OFFICES in the UNITED STATES

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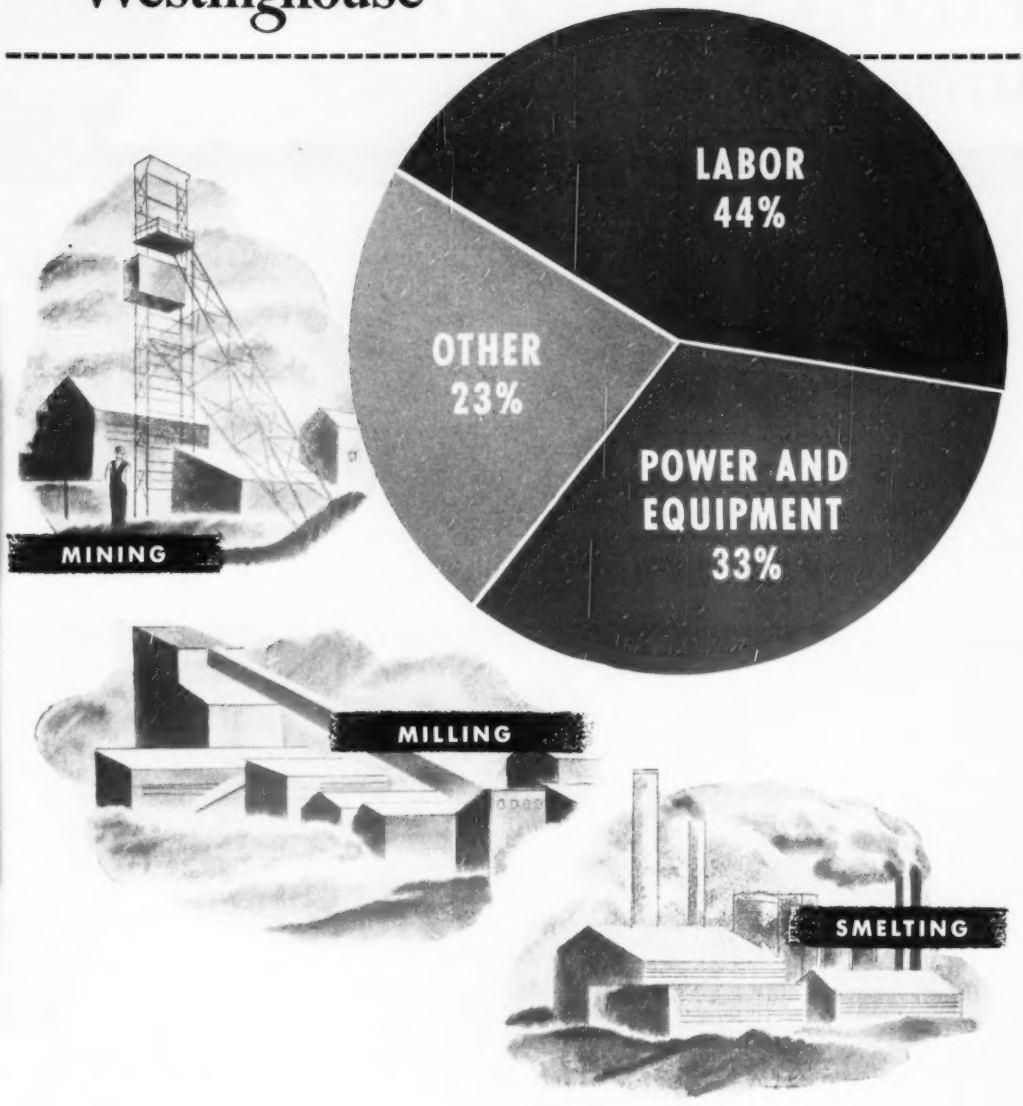
Representatives in Principal Cities in Mexico, Central and South America CABLE ADDRESS; "MINSAF" PITTSBURGH

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



EVERYTHING ELECTRICAL TO MINE ANYTHING

Have you studied your whole cost picture?

Labor is just one of your big cost items. Power and machinery themselves average 33% of the cost of mining ore.* Westinghouse can help you keep these costs in line—*because your electrical equipment has a major effect on them.*

Equipment Affects Basic Power Costs

In the first place, look at your actual power costs. Your power *distribution system* determines how much of the power you buy actually goes to work. A good system minimizes transmission losses and saves you money. And if you make your own power, the proper application of your generating apparatus will have a big effect on the balance sheet.

Influences Machine Efficiency

Perhaps even more important is the effect your electrical equipment has on machine efficiency—the return on your machine cost dollar. When the distribution system is right, voltage is properly maintained and motors deliver full rating. Drills, hoists, grinders, crushers, concentrators run as they're designed to. And they stay running without costly shutdown when their driving motors are carefully selected and power supply is dependable.

Equipment Itself Is Cost Factor

Finally, maintaining and replacing the electrical equipment itself can be a big factor on your books. If it's properly designed, properly built and properly *co-ordinated,* it is more efficient, runs longer and needs less attention.

Westinghouse Experience Can Help You

Building and co-ordinating electrical equipment to do the *best job* for your particular operation takes plenty of experience on the part of your engineers and your electrical manufacturer. For over 50 years Westinghouse has been helping the mining industry solve its electrical problems—and we've learned from experience how to meet *your particular needs.*

Westinghouse can supply the complete electrical equipment for your job. This simplifies your problems and, most important, you know the equipment is designed for strenuous mining service and designed to work together for maximum efficiency.

Let us help you review your present electrical setup now to be sure *all* of your production team is on the job. Just call your nearby Westinghouse office. And on future installations call in Westinghouse early in the planning stage. J-94849

*Typical 1000-ton/day mine

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

PERFORMANCE ✓ OUTSTANDING

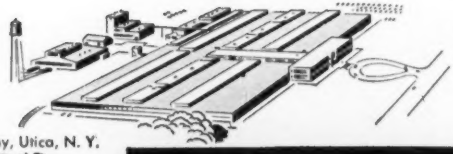
Here's a new sinker—the CP-59—that outperforms any other drill in its class (55 pounds). It has remarkably high drilling speed . . . exceptionally strong rotation . . . unsurpassed hole cleaning . . . excellent riding qualities.

Its design incorporates all the factors that make for fast, efficient, economical operation.

Low maintenance is assured by such features as a replaceable bronze chuck rotation nut to protect piston splines from scoring and a replaceable bronze cylinder bushing liner to make it easy to maintain piston alignment and full cushioning.

The CP-59 is equipped with a 4-in-1 backhead. Rapid and inexpensive changeovers make possible plain dry, blower dry, plain wet or air-wet operation.

Have your nearest CP dealer give you a demonstration of this outstanding drill, or write for a copy of SP-3009.



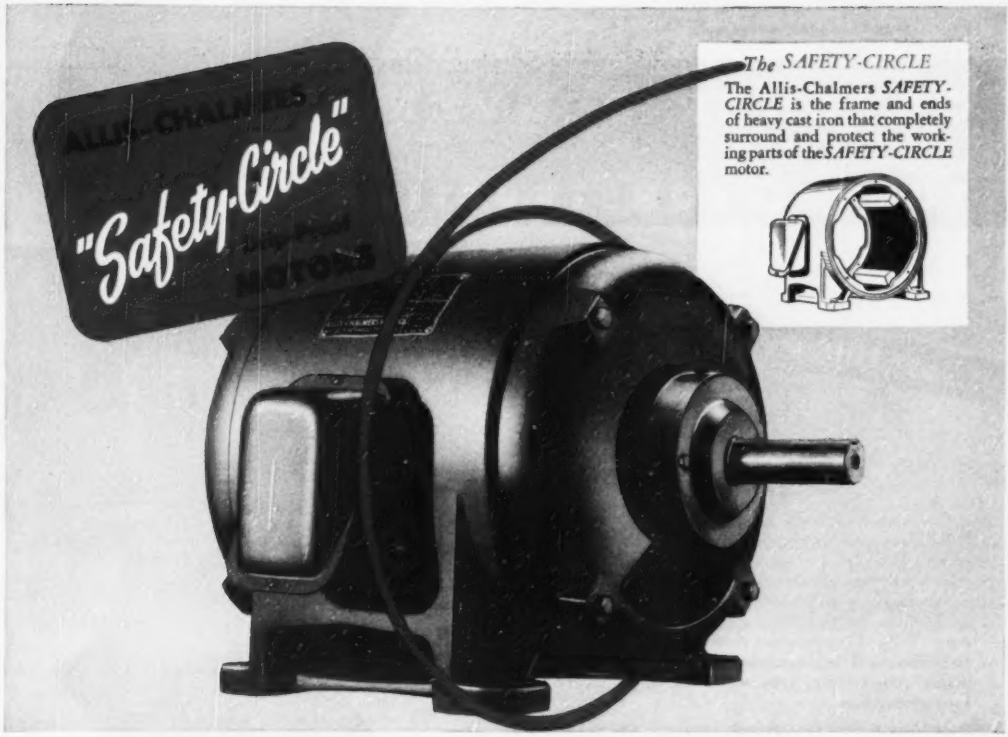
With its half million square feet of floor space, Chicago Pneumatic's new Utica unit is the world's most modern plant for the production of pneumatic and electric tools.

Chicago Pneumatic Tool Company, Utica, N. Y.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES


"Safety-Circle"
The SAFETY-CIRCLE
The Allis-Chalmers SAFETY-CIRCLE is the frame and ends of heavy cast iron that completely surround and protect the working parts of the SAFETY-CIRCLE motor.

SAFETY-CIRCLE means

★ All-Around Protection ★ Low Maintenance ★ Dependable Performance

A-3144

THE *SAFETY-CIRCLE* MOTOR is protected all around against those four great motor killers — corrosion . . . distortion . . . friction . . . foreign matter. The frame is of cast iron, the most corrosion-resistant material for this purpose.

The strength and stiffness of the cast iron is supplemented by ribbing and bracing to maintain alignment and prevent distortion. Ball bearings are lubricated and sealed at the factory. They require no attention for years. End brackets are drip-proof at no premium.

SAFETY-CIRCLE motors are fully protected inside, too. Multiple-dipped and multiple-baked stator plus extra inter-phase insulation provide extra protection against electrical breakdown.

With *SAFETY-CIRCLE* protection outside and protected working parts inside, you can count on years of trouble-free, low cost power.

For complete details on *SAFETY-CIRCLE* advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Stocked in sizes 1 to 20 hp. *SAFETY-CIRCLE*, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

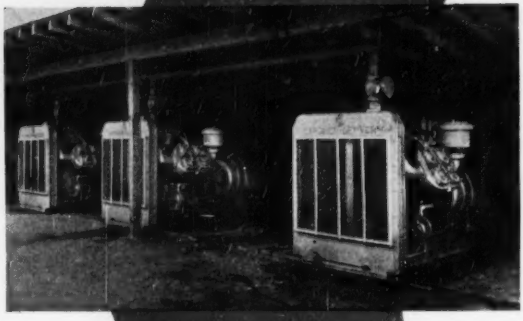
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

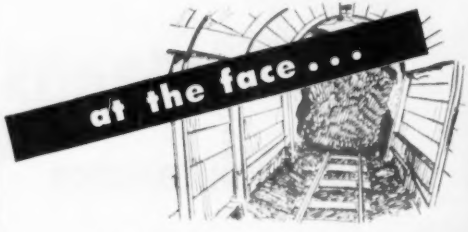
GARDNER-DENVER Speeds TUNNEL CONSTRUCTION

Ready to hook up and go — "packaged" WBJ Compressors require no special foundation — no water piping — no external cooling devices. That's why you get air power "on tap" days ahead of schedule — with a smaller investment in the compressor house. And remember, smooth-running WBJ Compressors — with balanced construction and self-contained cooling system — assure dependable, low-cost air to speed every foot of the bore.



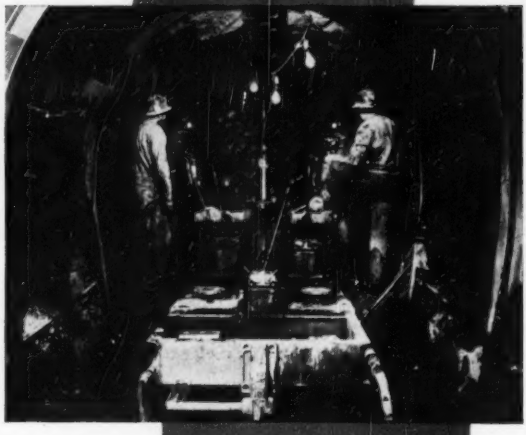
700 cubic foot WBJ Two-Stage Compressors are available with electric motor, diesel or gasoline engine drive.

Complete truck-mounted jumbos are equipped with one, two or three drill booms and a roof jack unit. Separate hydraulic boom and roof jack units are available in various lengths for your custom-built jumbo.



Save drilling time every round — choose versatile Gardner-Denver Hydraulic Drill Jumbos with *"creep-free"* booms. Faster on the setup — faster from hole to hole — faster tearing down. Handle up to 10-foot steel changes — give you low-cost drilling — faster, properly drilled rounds.

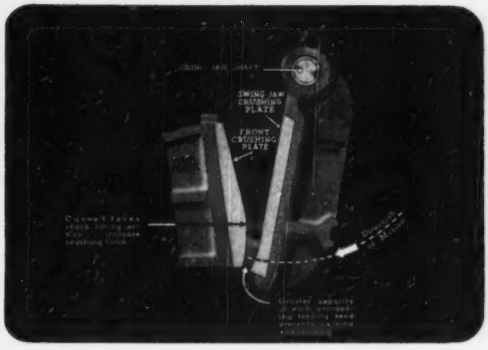
For complete information, write Gardner-Denver Company.



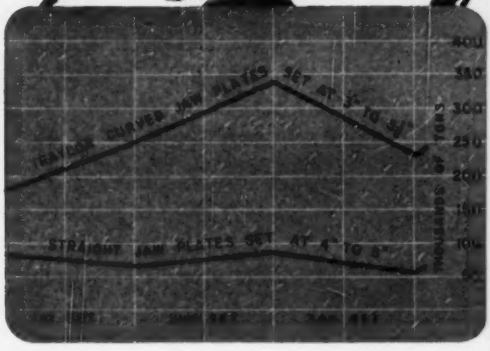
GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

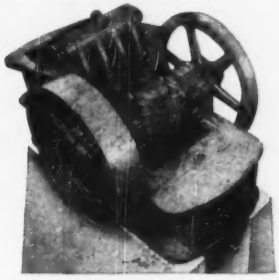
What do I Know about crushing



Plenty Mister! See those *curved* jaws of mine? When something gets between them it doesn't slip—it gets crushed! Nature *curved* my jaws to use every bit of strength for direct crushing. Traylor *curved* jaw plates use this same principle to attain outstanding performance.



For instance, records kept on a 36″ x 48″ crusher at a setting of 4″ to 5″ show the average life of straight jaw plates to be 96,500 tons per set. Traylor smooth-face *curved* jaw plates fitted to this crusher and *set at* 3″ to 3½″ *averaged* 276,724 *tons*.



Only Traylor smooth-face *curved* jaw plates, in a Traylor Jaw Crusher, like this Model HB, *or fitted to your present equipment* can give you this profitable performance. Traylor makes other jaw crushers, from 8″ x 12″ to 66″ x 86″, the largest and strongest in the world.

Write today for Bulletin 3105. It gives full details of the Traylor Model H and HB Jaw Crushers and clearly explains the operating principle of Traylor non-chokable, smooth-face *curved* jaw plates.

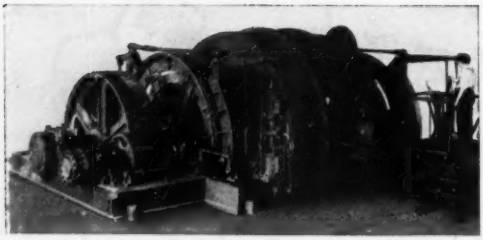
TRAYLOR ENGINEERING & MANUFACTURING CO.
188 Mill St., Allentown, Pa.

Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

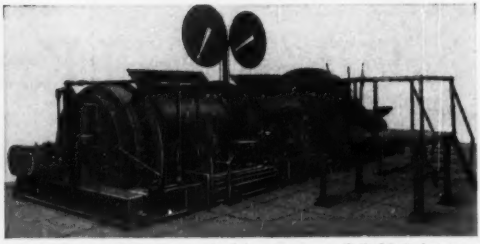
Traylor

Rotary Kilns, Coolers and Dryers
Grinding Mills · Crushing Rolls
Jaw, Reduction and Gyratory Crushers

A "TRAYLOR" LEADS TO GREATER PROFITS



1750 hp. Electric Hoist for coal-mining company. Cylindro-conical tight-and-loose drums are each 9 to 15 ft. in diameter; grooved for 1676 ft. of active 1⅝" rope. Equipped with air-operated brake and clutch engines and modern safety devices that provide dependable protection against any damage that might be caused by current failure, overwinding or overspeeding.



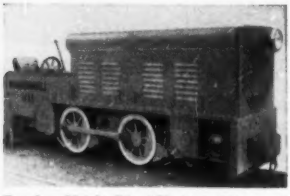
600 hp. Electric Hoist for metal-mining company. Cylindrical drums are each 7 ft. in diameter; grooved for 2650 ft. of active 1¼" rope. In addition to post-type brakes, oil-hydraulic brake and clutch engines and modern safety devices, this hoist is equipped with a system of dynamic braking that assures important savings in both operating and maintenance expense.

MINING EQUIPMENT

with a 101-Year Record of Satisfactory Service

Vulcan "Allcasteel" Sheave on modern headframe. Besides being light and very strong, Vulcan Allcasteel sheaves are so highly resistant to rope wear that NO LINERS ARE NEEDED. Available in a wide range of types and sizes with either plain or anti-friction bearings.

Standard 5 hp. Car-Spotting Hoist. Triple-reduction alloy-steel gears and other superior mechanical features assure long service life and low maintenance expense. We build room hoists, scraper hoists and other self-contained electric hoists in a wide variety of types and sizes to meet any probable requirement.

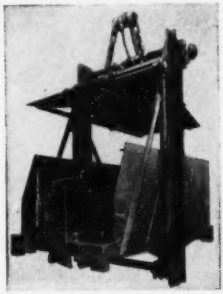


6-Ton Low-Height Diesel-Mechanical Locomotive for underground operation in a foreign country. Special equipment includes back-fire arrester and wet-type exhaust muffler. We also build Electric Mine Locomotives and all types of Diesel, Steam and Fireless Locomotives.

Located in the heart of the anthracite field, the Vulcan Iron Works has been building dependable mining equipment since 1849, taking full advantage at all times of every approved advance in design, materials and manufacturing methods. Unsurpassed facilities and a long-established policy of sturdy construction assure prompt deliveries and satisfactory service at lowest ultimate expense.

So many problems have been solved successfully during this long period of service to mining companies throughout the United States and many other countries that most requirements can now be taken care of successfully by utilizing some well-proved design with little or no modification. Our experienced engineers are always ready, however, to cooperate with the purchaser in the development of a new design to meet his particular operating conditions.

Write us regarding any requirement within the wide range of equipment listed below. We welcome opportunities to make helpful suggestions without charge or obligation. Bulletins on request.



Self-Dumping Cage for high-speed hoisting in a coal mine. We build many other types of cages for coal and metal mines; either from our own designs or to meet purchaser's specifications.

At left: Three-Deck Man Cage for metal mine. Small wheels with pneumatic tires are used, instead of guide shoes, to reduce the vibration and shocks of high-speed hoisting.
At right: Combination Man-Cage and Bottom-Discharge Skip for metal mine. Alloy-steel linings and rubber interlinings assure high resistance to corrosion, abrasion and loading shocks.

Vulcan Iron Works, Wilkes-Barre, Pa.

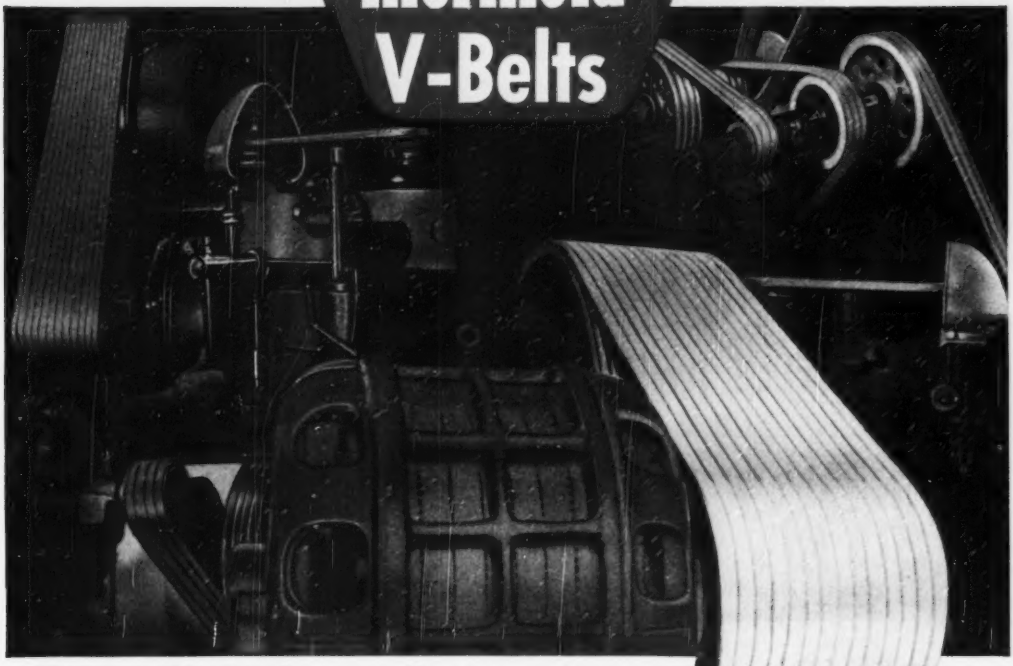
Heavy-Duty Electric Hoists
Self-Contained Hoists
Scraper Hoists
Car-Spotting Hoists
Room Hoists

Shaking-Chute Conveyors
Chain Conveyors
Cast-Steel Sheaves and Gears
Cages, Skips and Gunboats
Toothed Double-Roll Crushers

Steam Locomotives
Diesel Locomotives
geared and electric drive
Gasoline Locomotives
geared and electric drive

Load-Carrying Larries
Rotary Kilns, Coolers and Dryers
Briquetting Machines
Heavy Special Machinery
Open-Hearth Steel Castings

Specify Thermoid V-Belts



Thermoid V-Belts...Built to Last Longer ...Harness Industry's Horsepower!

From the smallest fractional horsepower size to the largest multiple V-Belt . . . Thermoid top-quality serves the needs of every industry. Thermoid V-Belts mean longer-than-average wear, maximum power transmission without slippage and lowest over-all operating costs.

Thermoid V-Belts are specially impregnated to withstand excess moisture . . . abrasion . . . acidity . . . all those elements that hasten belt deterioration. *They are prestretched to insure perfect operation without adjustments.*

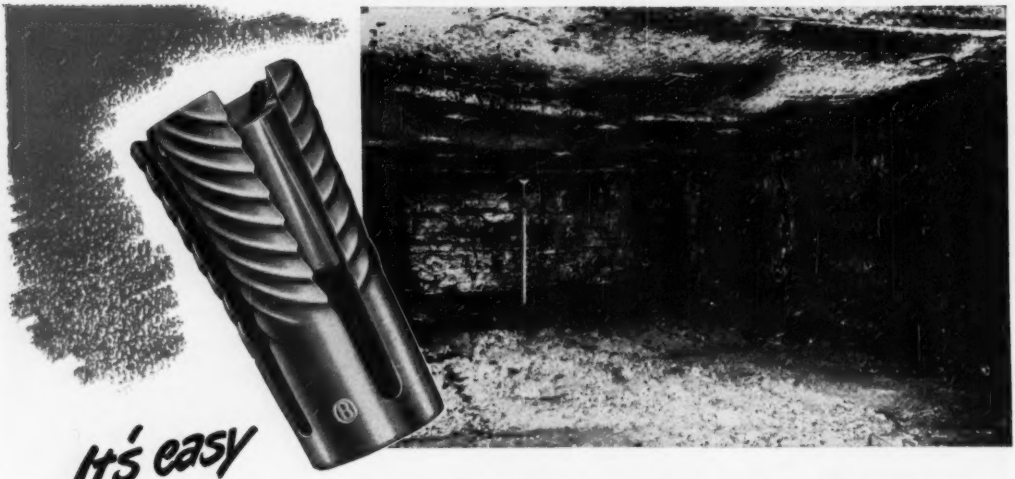
For smooth, efficient performance . . . for ability to absorb repeated shock loads . . . for lowest cost per hour . . . specify Thermoid V-Belts. Call your nearest Thermoid Distributor today. He has a complete range of sizes available to meet your requirements. And for your special belt problems, Thermoid Field Representatives are always available to help you select the right belt for the job.

It will pay you to ***Specify*** Thermoid

Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

Thermoid Company

Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U. S. A.
Industrial Rubber Products • Friction Materials • Oil Field Products



It's easy to use **O-B ROOF SUPPORT EXPANSION SHELLS AND PLUGS**

CONVENIENCE

Proper pre-expansion is established at the factory when the shell is driven onto the plug. This also assembles the shell and plug into an easy-to-handle unit to be turned onto the bolt later at the mine.

SPEED

See how you can do a good job—swiftly! With a few turns of the wrist and a sharp rap on the bottom, the plug is on the bolt and the shell rests on its support (Palnut, upset ear, etc.) ready to go up into the hole. (Rapping the bolt head on the floor separates the shell from the plug. Then the shell prongs are free to spring in to conform with the hole diameter.)

• O-B Roof Support Expansion Shells and Plugs provide an easy way for rapid and secure roof bolting, because they're especially designed for the job. If you are bolting to keep your roof in tip-top shape, you'll want to know how O-B Roof Support Expansion Shells and Plugs measure up for convenience, speed and dependability.

DEPENDABILITY

Of course you want good roof! If you are using bolting to get it, remember this about O-B Expansion Shells and Plugs:

Properly installed in right-size holes, O-B Expansion Shells and Plugs will develop the full tensile strength of the bolt.

• • •

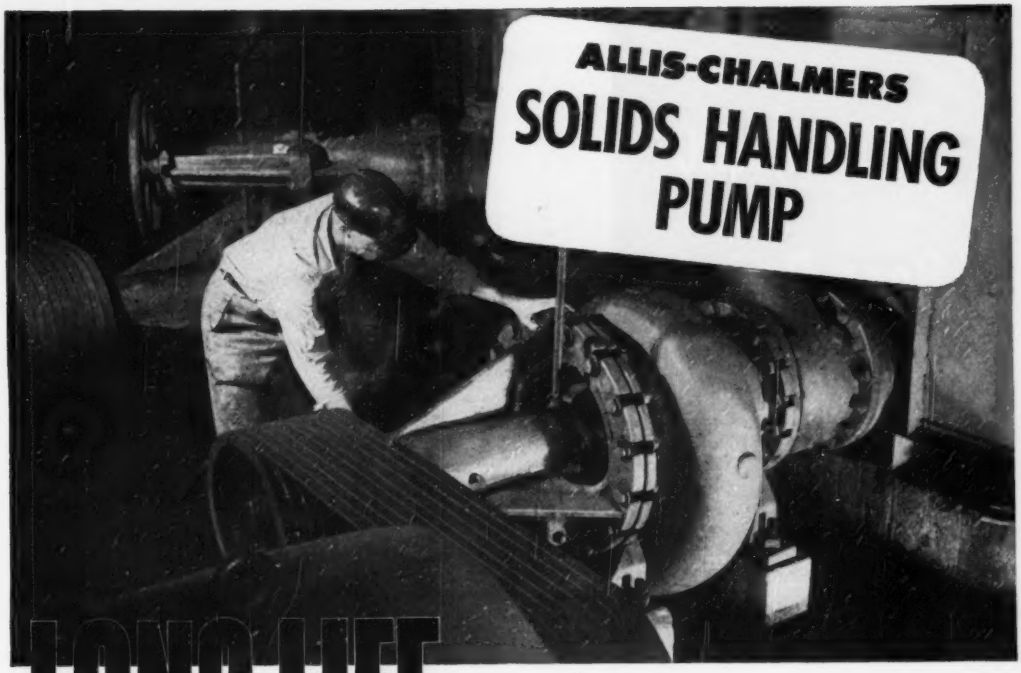
You can get more information on roof bolting. O-B field tests and observations, as well as clear illustrations of bolting procedure, are printed in our Bulletin No. 864-M. Use the coupon to get your copy.

4054-M(1)

OHIO BRASS COMPANY
Mansfield, Ohio
Please send me a copy of Bulletin No. 864-M.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

Ohio Brass
MANSFIELD OHIO, U. S. A.
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.



LONG LIFE plus easy servicing

GIVE YOU LOWER PUMPING COSTS

USERS HAVE REPORTED as much as four times longer life with Allis-Chalmers solids handling pumps because they are made of special hard *Allisite* alloy . . . because they have thicker sections and heavier parts throughout . . . and because they are application engineered by specialists who know solids handling problems and how to solve them.

Replace Worn Parts In Half Hour

When parts must be replaced, as they must in all solids handling pumps, you will save many hours of time and many dollars of expense with the Allis-Chalmers solids handling pump. This pump is designed with only five wearing parts, all made for easy handling and replacement. The pump can be torn down, an element replaced and the pump reassembled in less than a half hour. Piping need not be disturbed unless casing must be replaced.

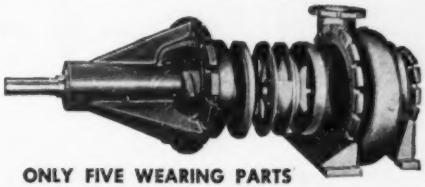
Three sets of bearings, brackets and shafts cover all pump sizes making spare parts inventory low regardless of the number of pumps you operate. Head and capacity can be changed instantly when the drive is equipped with the new *Vari-Pitch* Automatic sheave and *Texrope* V-belt drive.

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

Get The Facts Now

Discuss your solids handling equipment problems with an Allis-Chalmers pump engineer. He can show you dollars and cents savings you can make. Contact your A-C Sales Office today. Or write for Bulletin 08B6381. A-2988

Vari-Pitch, *Texrope* and *Allisite* are Allis-Chalmers trademarks.



ONLY FIVE WEARING PARTS

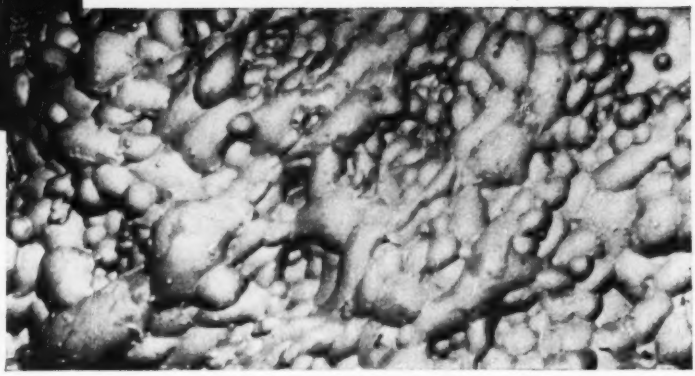
Shaft sleeve, impeller, casing, two wear plates. All easy to handle and easy to replace.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Dependable Bear Brand Xanthates

"Over Twenty-Five Years' Experience in Producing Xanthates for Metallurgical Use."



BEAR BRAND XANTHATES AVAILABLE

- **Z-3—Potassium Ethyl Xanthate**
- **Z-4—Sodium Ethyl Xanthate**
- **Z-5—Potassium Amyl Xanthate***
- **Z-6—Potassium Pentasol Amyl Xanthate***
- **Z-8—Potassium Sec.-Butyl Xanthate**
- **Z-9—Potassium Isopropyl Xanthate**

*From Sharples Amyl Alcohols

Time and experience have demonstrated that for optimum results in the flotation treatment of substantially all sulphide ores, as well as some oxidized ores and ores containing native metals, Bear Brand Xanthates are the cheapest and most efficient collectors now available.

Great Western Division
THE DOW CHEMICAL COMPANY
San Francisco 4, Calif., U.S.A.

GREAT WESTERN DIVISION · BEAR BRAND PRODUCTS · THE DOW CHEMICAL COMPANY

DOW

[redacted] MINING COMPANY

TEST DATA

DEPARTMENT Grinding & Concentrating

OBJECT of TEST: Using two of the present grinding sections (2 Mills/section) operate one with MARCY GRATE mills & one as Overflow. Determine the most efficient grinding mill for our work. Recommend which type to purchase for expanded plant.

OPERATING CONDITIONS

MARCY GRATE MILLS: Two 8'2" × 6' Mills per section. Each @ 80% Critical Speed or 22 RPM. 225 H.P. motors. Average section tonnage 928 Tons/24 hours. Ball Consumption 1.6#/ton. Average H.P. input 242. Average KWH/ton 9.34. Grind 5.5% +48 Mesh.

OVERFLOW SECTION: Two 8'2" × 6' mills. 22 RPM = 80% Critical Speed. 225 H.P. motors. Average section tonnage 646 Tons/24 hours. Ball wear 2.06#/ton. Average H.P. input 197. Average KWH/ton 10.89. Grind 6.3% +48 Mesh

SUMMARY	OVERFLOW SECTION	GRATE SECTION			REMARKS
Grind	6.3% +48M	5.5% +48M	.....	Slightly	Finer Grind (Grate)
Mill Size	(2) 8'2" × 6'	(2) 8'2" × 6'	.....		
Tons/24 hrs.	646	928	.....	282 Tons/sec.	more by Grates
KWH/ton	10.89	9.34	.....	1.55 KWH/ton	less by Grates
Ball Wear	2.06#/ton	1.6#/ton	.....	Grates show	less ball wear/ton

Recommend Grate Sections since each section will give us 43.7% more tonnage and a decrease of 14.2% power per ton of ore ground in comparison to overflow section. Place new order for Marcy Grate Mills.

[redacted]
MANAGER

OTHER PRODUCTS

Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

Main Office: DENVER, COLORADO, U.S.A.; El Paso; Salt Lake City: 1775 Broadway, New York, N. Y.; Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Corp., 80 Broad St., New York 4, N. Y., Representatives for Continental Europe.

THE Mine & Smelter SUPPLY COMPANY

SYMONS CONE CRUSHERS . . . SYMONS CONE CRUSHERS . . . SYMONS CONE CRUSHERS . . .

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT
This is the Coppus VENTAIR. A centrifugal blower. It is designed for long pipe lines, high pressures.
This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.

These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corp., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
289 Park Avenue, Worcester 2, Mass.

Please send.....Bulletin 130

Name .....

Company .....

Address .....

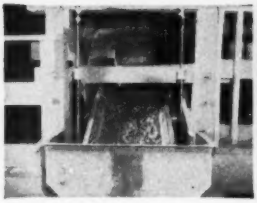
FLOTATION FOR SELECTIVE... RESULTS

ARIZONA BARITE CO. USES... DENVER FLOTATION EQUIPMENT

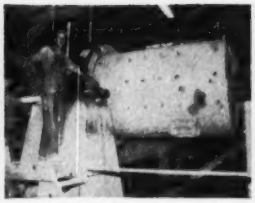
Following test work by U S. Bureau of Mines, Arizona Bureau of Mines and Deco Ore Testing Division, a selective flotation circuit was added to the Arizona Barite operation to meet market specifications for Barite used by the oil industry.

●

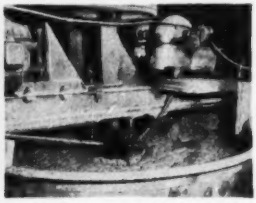
Complete Arizona Barite Company operating story appears in July-August 1950 Deco Trefoil. Write, wire or 'phone today for detailed information on Deco ore testing and equipment service.



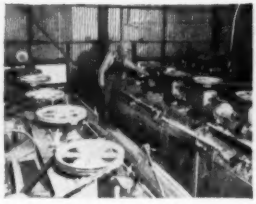
SCREENING: Note the absence of fines on this 4'x6' Denver-Dillon Vibrating Screen. Such efficient screening is produced by the "circle throw" motion of the screen.



GRINDING: Up to 200 tons per day of 75% $BaSO_4$ is handled per day in this 5'x8' Denver Steel-Head Ball Mill. Ball and liner consumption is low.

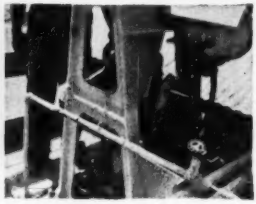


CONDITIONING: Classifier overflow is conditioned in a 5'x5' Denver Super Agitator. Flow of feed directly to agitation zone gives maximum reagent contact with pulp particles.

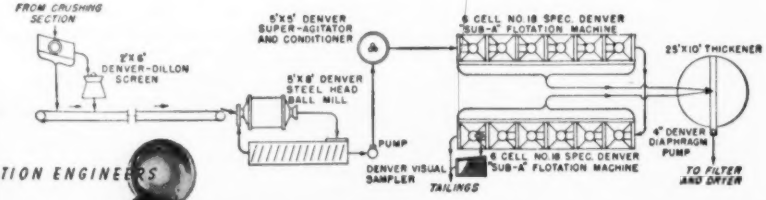


FLOTATION: Average feed per day is 125 tons of 75% $BaSO_4$. Grade of Barite is raised to 90% $BaSO_4$ in two 6-cell Denver "Sub-A" Flotation Machines operated in series.

FLEXIBILITY: Each of the 12 Denver "Sub-A" cells produce a finished high grade concentrate. Note uniform bubble structure. Flexibility permits cleaning and recleaning if ore changes.



PUMPING: A 4" Simplex Denver Adjustable Stroke Diaphragm Pump meters the flow of thickened pulp. Adjustable feature (while pump operates) permits critical Barite control.


FROM CRUSHING SECTION
2'X 6' DENVER-DILLON SCREEN
5'X5' DENVER SUPER-AGITATOR AND CONDITIONER
5'X8' DENVER STEEL HEAD BALL MILL
PUMP
DENVER VISUAL SAMPLER
TAILINGS
6 CELL NO.18 SPEC. DENVER "SUB-A" FLOTATION MACHINE
6 CELL NO.18 SPEC. DENVER "SUB-A" FLOTATION MACHINE
25'X10' THICKENER
4" DENVER DIAPHRAGM PUMP
TO FILTER AND DRYER

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

FLOTATION ENGINEERS

"The firm that makes its friends happier, healthier and wealthier"

DENVER • NEW YORK • CHICAGO • EL PASO • VANCOUVER • TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG • RICHMOND

DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado

POINTS TO CONSIDER BEFORE YOU BUY YOUR NEXT CONVEYOR BELT

Shown on this page are some of the reasons why more and more economy-minded operators are planning to have their next conveyor belt built on Du Pont Cordura* High Tenacity Rayon.

"Cordura" has so much extra strength over natural fibers previously used that it provides a thinner yet stronger belt . . . at no extra cost.

You may already know "Cordura" Rayon as the yarn that makes tougher truck tires, stronger high-pressure hose and longer-lasting V-belts. We'll be glad to send you the names of suppliers of conveyor belts improved with this industrial rayon.

You can also get full information about "Cordura" in the new manual, "Sinews for Industry." It gives physical properties of "Cordura" rayon, describes many successful applications and tells how "Cordura" improves the efficiency of conveyor systems. For your free copy, address Room 4529, Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

Reg. U. S. Pat. Off.

LONGER LIFTS. The high tensile strength of "Cordura" Rayon eliminates costly transfer points. For example, a belt reinforced with seven plies of "Cordura" can lift 1000 tons of overburden per hour up a 15° slope over 1000-foot centers. It has design tension of 900 pounds per inch of width.

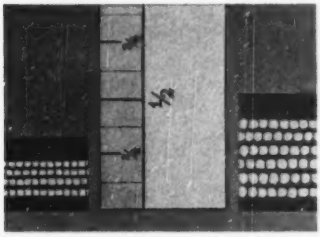
DU PONT "CORDURA" HIGH TENACITY RAYON

DU PONT

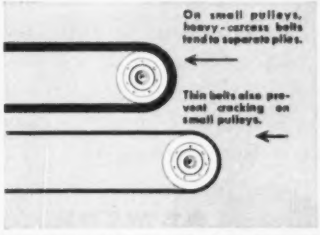
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

for RAYON . . . for NYLON . . . for fibers to come look to DU PONT



GREATER STRENGTH of belts built with "Cordura" is illustrated above. At left is cross-section of four-ply belt sinewed with "Cordura." It's stronger than conventional 6-ply belt at right, yet only half as thick. This thin, light belt is particularly desirable where panel equipment is moved frequently.



MORE FLEXIBLE. Belts built with "Cordura" have less tendency to crack and separate plies when run over small pulleys required in confined working space. And belts built with "Cordura" have less stretch, so less take-up room is needed. And they trough well under any loading conditions.

HEAVIER LOADING is possible on conveyor belts built with Du Pont "Cordura" High Tenacity Rayon. This yarn is inherently stronger than the natural fibers commonly used. It packs extra strength into conveyor belts and enables them to carry loads to the capacity of power equipment.

Iron Ore Travels Fast at Bargain Rates

Delivering, by continuous flow, 250 tons of iron ore an hour from the main drifts to the vertical shaft is the big job an S-A Belt Conveyor System is doing at this mine. By maintaining this high volume in a uniform flow, ore production has been increased, operations simplified and power and handling costs per ton reduced.

For nearly 50 years, S-A has been designing and equipping conveying systems for moving bulk materials at lowest cost per ton. When you bring your bulk handling problems to S-A for recommendations, you get the benefit of years of experience gained through the solution of thousands of similar conveying problems. Write us today.

Three separate 36" belt conveyors, each operating in one of the three main drifts at the 1200 ft. level, brings iron ore out of the drifts to the vertical shaft, where it is hoisted to the surface. Conveyor No. 1 is 818 ft. long, Conveyor No. 2 is 648 ft. long, Conveyor No. 3 is 635 ft. long. Each can handle 250 tons per hour, at a speed of 200 ft. per min. Ore is brought from side drifts off the main drifts by shaker units and deposited on the belt conveyors.

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

ALLIS-CHALMERS

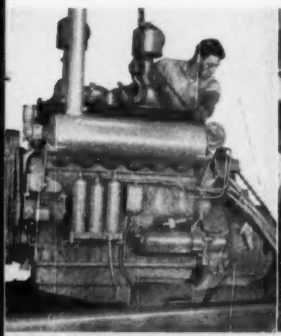
Design Simplicity

Another Big Reason Why HD-19 Leads in Tractor Output

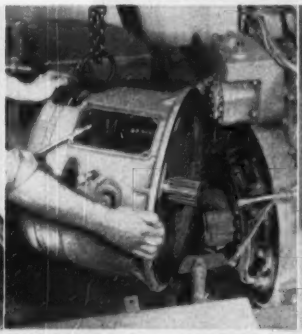
Gears, pinions and bearings by the dozen have been eliminated in the HD-19. This means fewer parts to wear — fewer breakdowns and fewer repair bills.

When maintenance is necessary, each assembly is readily accessible for attention. The HD-19 is designed so that each major unit may be easily removed and repaired or replaced *right on the job* without removing unrelated parts. The time and labor saved means substantial increases in the HD-19's over-all output. Remember, a tractor makes money for an owner only when it's working.

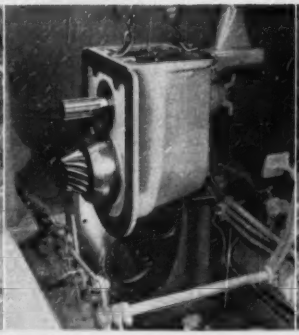
Simple unit assembly is another important reason why the HD-19 is low in total down time required for servicing and maintenance . . . why it is tops in output per day, per month, per season.



Engine can be removed without disassembling clutch.

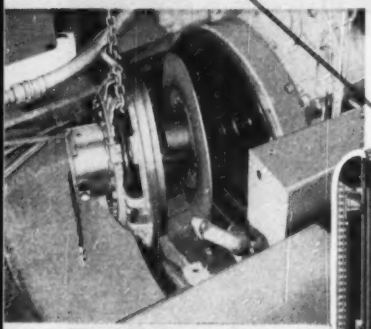


Torque converter can be removed without disturbing engine or transmission.

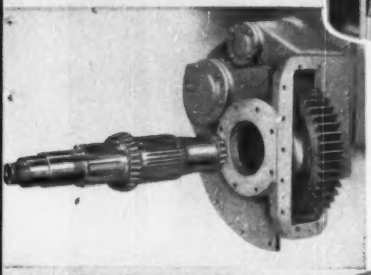


Transmission can be removed as a complete unit without removing clutch, final drive or bevel gear.

Each steering clutch can be removed independently and without disturbing final drive or bevel gear.



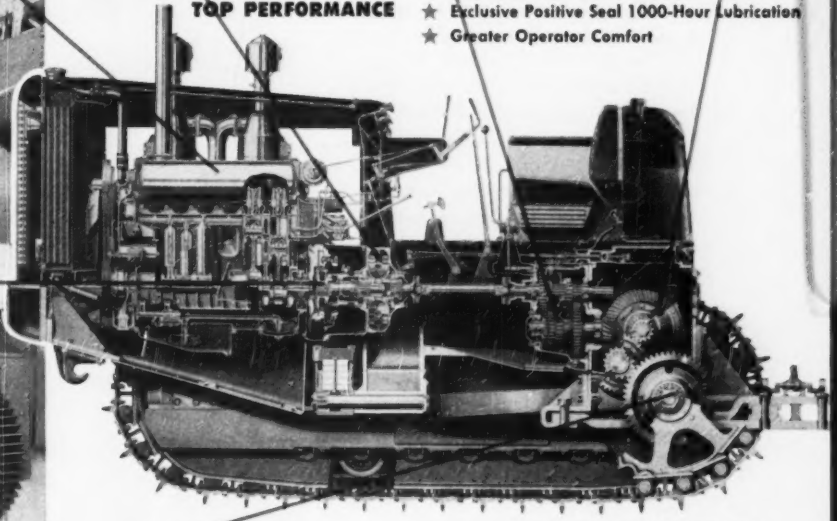
Clutch assembly can be removed without disturbing either engine or transmission.



Final drive gear and intermediate gear can be removed without disturbing steering clutch.

MORE REASONS FOR HD-19 TOP PERFORMANCE

- ★ Torque Converter Drive
- ★ 40,000 lb. of Balanced Weight
- ★ Exclusive Positive Seal 1000-Hour Lubrication
- ★ Greater Operator Comfort



. . . For Greater Production

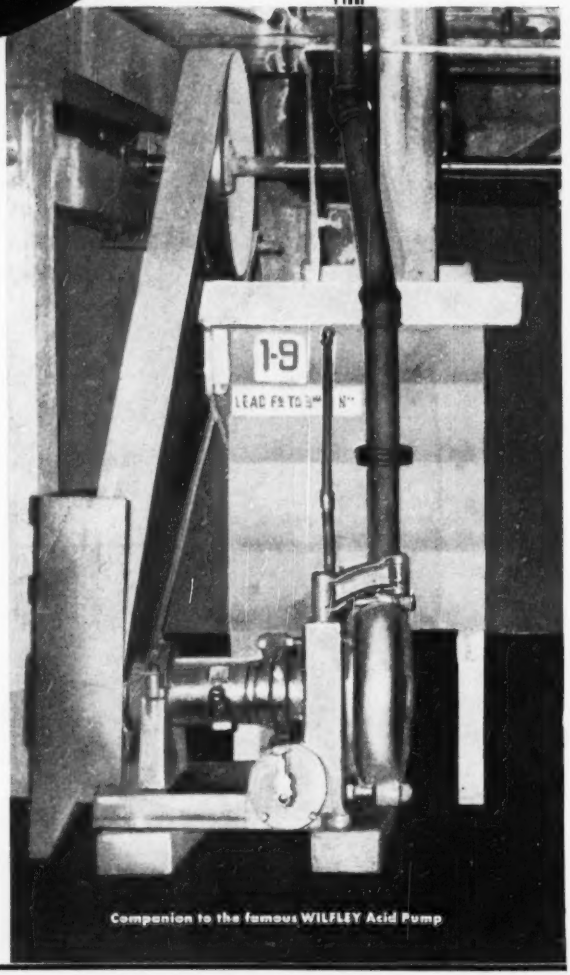
. . . For Easier Operation . . . For Simplified Servicing

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

WILFLEY
centrifugal PUMPS

for lead concentrates



Companion to the famous WILFLEY Acid Pump

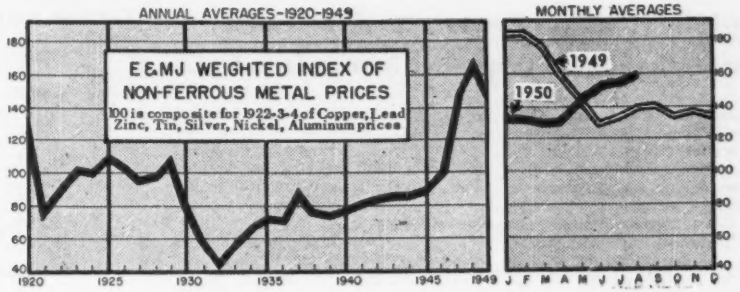
For Over 20 Years, this WILFLEY Centrifugal Pump has been operating continuously—handling lead concentrates efficiently with only occasional replacement of wear parts—at a well-known Pacific northwest mill. WILFLEY Pumps are famous for delivering trouble-free performance without attention—stepped-up production and actual dollar savings in power and operation (wherever mill concentrates must be handled economically). There is a highly efficient, cost-reducing WILFLEY Pump size for every pumping requirement. Individual engineering on every application. *Write or wire for complete details.*

Buy **WILFLEY** *for cost-saving performance*

A. R. WILFLEY & SONS, INC.
DENVER, COLORADO, U.S.A.
New York Office:
1775 Broadway • New York City

E&MJ OUTLOOK

PRICES



MARKETS

With buyers grasping for all of the major non-ferrous metals they can lay their hands on, and production already well sold up, prices have strengthened all along the line. Fear of controls was the major factor stimulating demand. Producers see active business right through to the end of the year. The trend in prices looks upward, and there is no telling at this moment at what level they will stabilize.

E&MJ's index of non-ferrous metal prices rose to 160.86 in August. This compares with 156.40 in July. Our monthly averages were higher in copper, lead, zinc, tin, quicksilver, platinum and antimony.

AT HOME

The shortage of skilled miners and key personnel is even more widespread than indicated in the industry survey discussed on pp. 63-65 of this issue. Unless checked, this trend will block increased mine output.

Look for allocation and price controls for tin, copper, and zinc—possibly also for steel, aluminum and lead.

Some form of Government aid is expected soon to stimulate domestic production of strategic materials that are in short supply and not available abroad in large quantities. **Subsidies or contracts at prices above the market** are cited as alternatives.

Mine-Mill is now reduced to a hard core offering much stiffer resistance to opponents of its policies. A federation of the left-wing unions that have been kicked out of CIO is definitely in sight.

Domestic uranium producers are assured of a market until Mar. 31, 1958. Minimum prices and other policies for purchase of ores, concentrates and precipitates were outlined Aug. 30 at Salt Lake City by Jesse C. Johnson, manager of AEC's Raw Materials Operations. Circular No. 5 governing purchase of Colorado Plateau ores (see E&MJ, Dec. 1949, pp. 70-71) will also be extended until Mar. 31, 1958.

ABROAD

Geologists and engineers of Bethlehem Steel Co. are **exploring manganese deposits** in the Amapa district of Brazil near the mouth of the Amazon River. Preliminary studies for railroads and port facilities are also under way.

Jamaica Bauxites, Ltd., subsidiary of Aluminium, Ltd., Montreal, will **build an $8-million, 100-ton-per-day alumina plant** in Jamaica. If successful, an additional $30 million may be invested to expand output 10-fold.

Yugoslavia received another $15 million from Export-Import Bank for mining, agriculture, and production equipment. This will raise the total amount of recent loans to Yugoslavia to $55 million.

MARKETS—Trends and Prices

Higher Prices Paid for Copper, Lead, Zinc and Tin—No Slackening in Consumer Demands in Sight

THE SCRAMBLE on the part of fabricators to obtain non-ferrous metals continued throughout August. With the civilian economy moving into even higher ground, and the defense program certain to reduce the available supply of raw materials, producers in numerous instances had to resort to allocation to maintain an orderly market. The trend in prices was upward. Inflationary pressures have increased and the counter measures taken so far have been ineffective in reducing the over-all demand for goods.

As the month ended, the House-Senate conferees approved the bill granting wage, price, rationing and priority powers to President Truman. Legislation aimed at suspending the import duty on copper was tabled by the Senate Finance Committee on Aug. 8. As a result of this action the confusion over the price situation in copper increased. Senator McMahon (Conn.), in an almost last minute drive to extend the period of free entry of copper, requested that the amendment be debated on the floor of the Senate when the general tax bill comes up for consideration. The Munitions Board has revised its stockpile buying policy to the extent that payment in excess of 25% above the market price would be authorized on certain critical materials of domestic origin.

The E&MJ index of non-ferrous metal prices rose to 160.67 in August, which compares with 156.40 a month previous and 141.90 a year ago. In August of 1948 our index stood at 177.68.

Copper Price Confusion

With tariff uncertainty still hanging over the copper industry, and premium prices prevailing in the outside market, sellers of domestic copper were thrown into a state of general confusion when Calumet & Hecla, a Michigan producer, the American Smelting & Refining Co., and the American Metal Co. advanced their prices 2c. per pound. Other sellers held to the 22½c. basis. Based on sales of copper to domestic consumers, our daily averages, beginning Aug. 22, showed variations from the 22½c. basis.

In the outside market, in which dealer business plays an important part, prices paid varied between 26c. and 29½c. per pound.

Primary producers sold slightly more than 106,500 tons of copper for August shipment to fabricators.

New business booked by fabricators during July contained the equivalent of 190,967 tons of copper, which compares with 127,639 tons in June. The rush for copper products points to "protective" buying on the part of the consumer.

Copper contained in products shipped by fabricators to their customers during July totaled 97,938 tons, which compares with 132,558 tons shipped in June. Owing to a combination of circumstances, including such factors as the vacation period at important plants and the unsettled tariff problem, a decline in deliveries was expected.

Producers' deliveries to fabricating plants and shipments of copper products (copper content) by fabricators to their customers in the seven months ended July, in tons:

	Producer Deliveries	Fabricator Shipments
January	111,668	108,921
February	112,773	102,896
March	123,030	106,644
April	101,729	124,032
May	113,837	133,365
June	126,047	132,558
July	95,983	97,938
Total	785,067	806,354

Stocks of refined copper in the hands of fabricators at the end of July totaled 329,785 tons, which compares with 332,330 tons a month previous and 325,409 tons a year ago.

Unfilled orders increased from 212,400 tons at the end of June to 305,430 tons at the end of July.

Recent statistics of Copper Institute indicate that stocks of refined copper in the hands of domestic producers at the end of July declined to 48,266 tons. The copper statistics for June and July, in tons, follow:

United States

	(a) June	July
Production		
Crude, primary	78,962	76,640
Crude, secondary	17,792	8,675
Totals	96,754	85,315
Refined copper	113,961	96,734
Deliveries, refined	126,047	95,983
Stocks at end, refined	50,327	48,266

Outside United States

	(a) June	July
Production		
Crude, primary	106,491	120,437
Crude, secondary	1,615	933
Totals	108,106	121,370
Refined copper	91,145	94,609
Deliveries, refined	64,566	69,062
Stock at end, refined	136,482	140,366

(a) Corrected.

The foreign market for copper was quotably unchanged until the last day of August. Demands were fairly heavy, inspired in part by the strong situation developing in this country. Export copper sold abroad at 24½c. f.a.s. N. Y. on Aug. 31.

Continued heavy purchases of lead caused the price to rise 2c. per pound. The price was maintained at 12c. until Aug. 15, when it advanced to 13c. Another 1c. advance occurred on Aug. 21, establishing the quotation at 14c. per pound, New York. Buyers took all of the metal that producers cared to part with, and, in some instances, they obtained metal for delivery over the remainder of the year. The undertone was strong and talk of a 15c. market had solid backing.

Tempest in Zinc

The extremely tight situation in zinc showed no signs of easing. Most of the new business booked was placed on an average price basis, creating a thin market and a strong price situation. Unusual consumer demands and stockpile purchases reduced the stocks of slab zinc in the hands of producers to 19,687 tons at the end of July, the lowest level since 1941. Production in July was 77,868 tons. The

Average Prices for August (E&MJ Quotations)

Copper:	
Electrolytic, Domestic, Refinery	22.272
Electrolytic, Export, Refinery	22.499
Lead:	
Common, New York	12.926
Common, St. Louis	12.726
Silver and Sterling Exchange:	
Silver, New York, per oz.	72.750
Silver, London, pence per oz.	63.500
Sterling Exchange, "Checks"	280.000
Zinc:	
Prime Western, East St. Louis	15.052
Tin:	
New York Straits	102.194
New York, 99% min. (e)	101.194
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$78.000
Antimony (E&MJ) (d)	27.928
Antimony, bulk, Laredo	24.648
Antimony, in cases, Laredo	25.148
Platinum, refined, per oz.	75.189
Cadmium (a)	215.000
Cadmium (b)	222.500
Cadmium (c)	230.000
Aluminum, 99% plus, ingot	17.500
Magnesium, ingot	22.500
Nickel (f)	48.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot packed in cases, f.o.b. New York.

(e) Tin contained.

(f) F.o.b. Port Colborne, U. S. duty included.

month's shipments to domestic zinc consumers amounted to 67,119 tons, for export 371 tons, and on Government account 17,356 tons.

Under prevailing strained conditions, most operators contend that the 15c. basis for Prime Western is high enough to bring out full production. Some mine operators did not subscribe to this view. On Aug. 29, a small Western producer reported the sale of a round lot of High Grade and Special High on the basis of 16½ c. for Prime Western, East St. Louis. Sales at 15c. on that day were light and our average moved up to 16.400c. On the following day business was recorded at 15c. As the month ended the confusion over the price situation in zinc almost paralleled that of copper. In the foreign market as high as 18c. f.a.s. Gulf ports was paid for Prime Western.

Tin prices fluctuated over a wide range, moving up to $1.07½, then falling below $1 as the month ended.

Apprehension over political developments in the Far East made for a nervous market. So far, however, production at the mines has been maintained at around 14,000 long tons a month.

Refined platinum advanced on Aug. 30 to $87@$90 an ounce troy. Antimony was firmer. Foreign tungsten ore advanced sharply to $29 a short ton unit, duty paid. Manganese ore quotations were nominal.

(*Continued on page* 101)

Major Metals

U. S. DAILY AND AVERAGE PRICES

	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
August 1950						
1	22.200	22.425	97.500	12.000	11.800	15.000
2	22.200	22.425	98.000	12.000	11.800	15.000
3	22.200	22.425	97.750	12.000	11.800	15.000
4	22.200	22.425	98.500	12.000	11.800	15.000
5	No Market	22.425	98.500	12.000	11.800	15.000
7	22.200	22.425	98.500	12.000	11.800	15.000
8	22.200	22.425	99.250	12.000	11.800	15.000
9	22.200	22.425	101.500	12.000	11.800	15.000
10	22.200	22.425	103.000	12.000	11.800	15.000
11	22.200	22.425	105.000	12.000	11.800	15.000
12	No Market	22.425	105.000	12.000	11.800	15.000
14	22.200	22.425	106.000	12.000	11.800	15.000
15	22.200	22.425	107.500	13.000	12.800	15.000
16	22.200	22.425	107.000	13.000	12.800	15.000
17	22.200	22.425	101.000	13.000	12.800	15.000
18	22.200	22.425	102.000	13.000	12.800	15.000
19	No Market	22.425	102.000	13.000	12.800	15.000
21	22.200	22.425	107.500	14.000	13.800	15.000
22	22.250	22.425	106.000	14.000	13.800	15.000
23	22.300	22.425	103.000	14.000	13.800	15.000
24	22.200	22.425	104.000	14.000	13.800	15.000
25	22.225	22.425	104.500	14.000	13.800	15.000
26	No Market	22.425	104.000	14.000	13.800	15.000
28	22.200	22.425	102.000	14.000	13.800	15.000
29	22.230	22.425	102.000	14.000	13.800	16.400
30	22.250	22.425	99.750	14.000	13.800	15.000
31	23.600	24.425	98.500	14.000	13.800	15.000
AVERAGES FOR MONTH						
August	22.272	22.499	102.194	12.926	12.726	15.052
AVERAGES FOR WEEK						
August						
2	22.200	22.425	96.417	12.000	11.800	15.000
9	22.200	22.425	99.800	12.000	11.800	15.000
16	22.200	22.425	105.583	12.333	12.133	15.000
23	22.230	22.425	103.583	13.500	13.300	15.000
30	22.221	22.425	102.708	14.000	13.800	15.233
CALENDAR WEEK AVERAGES						
August						
5	22.200	22.425	97.625	12.000	11.800	15.000
12	22.200	22.425	102.042	12.000	11.800	15.000
19	22.200	22.425	104.250	12.833	12.633	15.000
26	22.235	22.425	104.833	14.000	13.800	15.000

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West command a premium of 1.10c. per pound over the current market for Prime Western; Special High Grade 1.25c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
August 1950					
1	$280.000	72.750	63.500d.	248s.	$35.00
2	280.000	72.750	63.500d.	248s.	35.00
3	280.000	72.750	63.500d.	248s.	35.00
4	280.000	72.750	63.500d.	248s.	35.00
5	(e)	(e)	(e)	(e)	35.00
7	280.000	Closed	Closed	Closed	35.00
8	280.000	72.750	63.500d.	248s.	35.00
9	280.000	72.750	63.500d.	248s.	35.00
10	280.000	72.750	63.500d.	248s.	35.00
11	280.000	72.750	63.500d.	248s.	35.00
12	(e)	(e)	(e)	(e)	35.00
14	280.000	72.750	63.500d.	248s.	35.00
15	280.000	72.750	63.500d.	248s.	35.00
16	280.000	72.750	63.500d.	248s.	35.00
17	280.000	72.750	63.500d.	248s.	35.00
18	280.000	72.750	63.500d.	248s.	35.00
19	(e)	(e)	(e)	(e)	35.00
21	280.000	72.750	63.500d.	248s.	35.00
22	280.000	72.750	63.500d.	248s.	35.00
23	280.000	72.750	63.500d.	248s.	35.00
24	280.000	72.750	63.500d.	248s.	35.00
25	280.000	72.750	63.500d.	248s.	35.00
26	(e)	(e)	(e)	(e)	35.00
28	280.000	72.750	63.500d.	248s.	35.00
29	280.000	72.750	63.500d.	248s.	35.00
30	280.000	72.750	63.500d.	248s.	35.00
31	280.000	72.750	63.500d.	248s.	35.00
AVERAGES FOR MONTH					
August	280.000	72.750	63.500d.	—	35.00
AVERAGES FOR WEEK					
August					
2	280.000	72.750	—	—	—
9	280.000	72.750	—	—	—
16	280.000	72.750	—	—	—
23	280.000	72.750	—	—	—
30	280.000	72.750	—	—	—

Calendar week averages: New York Silver: 5th, 72.750; 12th, 72.750; 19th, 72.750; 26th, 72.750.

(e) No market (Saturday).

Quotations for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines...

G. P. Lutjen

» **"This may leak a little,"** Percy Gardner, Jr., said as he turned a valve to demonstrate his hydraulic material lift to E&MJ visitors. A moment later a Bikini-like geyser nearly drowned all hands. Heroically, Mr. Gardner brought the eruption under control and held damage to the mere drenching pictured above (l. to r., R. W. Davis and J. B. Huttl of E&MJ, and Mr. Gardner).

The incident took place at the Silver Dollar property in Idaho, where Mr. Gardner designed and built his Hydraulic Material Lift (p. 84). All bugs have now been worked out, patent applied for, and now E&MJ brings you the story on this invention.

» **In our July column** we printed a little item on the fine work of the geologists in bringing the Galena-Platteville area back into production, in an effort to give a little background for the article on the new Calumet & Hecla mill which appeared in that issue.

So far as we can see, the chief effect of that paragraph has been to rate us a reproachful letter from one of the USGS people at Platteville for overlooking the work of his outfit on that deal. For the record, we hereby acknowledge the important contributions of the USGS (they wrote up the story for us in the July, 1949, issue) and tender them our apologies.

» **Going up in the air** to find radioactive deposits is a new method of prospecting for uranium, and it imposes some new qualifications for the geologist, one of which is a good stomach. Hedge hopping with a DC-3 at an altitude of 500 ft. or less over any but the flattest kind of terrain, particularly after 10 a.m. when the ground heat currents are on the move, tends to develop "butterflies" in all but the hardiest. Mother Sills' pills have been superseded by dramamine tablets, and these provide a certain factor of safety for the airborne geologist. The best bet, however, for the type of prospecting described by Frank W. Stead in his article, "Airborne Radioactivity Surveying" (p. 74), is the "rugged" geologist who flies without the benefit of medication.

» **"Pressure and Rockbursts from a Practical Point of View"** is exactly that; a discussion of the subject without resorting to complicated or theoretical formulas (p. 90). Author M. L. Johnston supplies the material from 15 years' experience in South Africa, where he was with the Government Miners Training School. At various times he was principal in schools at Simmer & Jack, Crown Mines and West Rand Consolidated. These schools usually had about 80 European trainees and 500 native laborers under the supervision of some 20 instructors.

» **People who are inclined to worry** certainly have a choice selection of items to do their worrying about these days. "Every man to his own worry" is our motto, but we think that one particular mining worry of the mining industry deserves consideration from a lot of other people, too. What will be done to make sure that our mines will be able to supply the wherewithal to defend the U. S. and the United Nations?

In this issue (p. 63) E&MJ has made an attempt to add up the score and with the cooperation of mine managers, superintendents and presidents all over the country, has been able to come with good estimate of what can be done and what it will take to do it.

» **Not that it matters,** but the Russians are currently upset about American football, which they term, "organized murder." They say it's all a capitalistic plot to stir the masses into a "bestial frame of mind for World War III." As a horrible example, the Moscow radio put the finger on the University of Michigan, where "players are often carried from the football field to the hospital or even straight to the cemetery."

The exclusive exposé makes it clear that profit-hungry Wall Street spare neither blood nor lives to gain its unwholesome ends and "football players are forced obediently to carry out the order of their bosses under the threat of unemployment."

Wonder how the Soviets feel about the Junior Prom as an American Institution.

"BIGSBY, IF YOU WANT TO TALK TO ME ABOUT COMBUSTION HAZARDS, MAKE AN APPOINTMENT... DON'T COME BUSTING IN LIKE THIS!"

COURTESY MINE-LOCO INSTRUMENTS COMPANY

Emergency Mine Production Must Be Safeguarded Now

Manpower problem, lagging development work, seen as chief issues demanding action in survey of mining industry's preparedness for coming emergency

SURELY NO ONE CAN LONGER DOUBT that this nation faces an emergency as grave as any in its history. We may come out of it without full-scale war, and we may not. The article following this one analyzes the probabilities in this respect.

But whatever happens, there can be little question that the metal mining industry is in for a period of stress that will tax its human and material resources heavily. How well is the industry prepared to meet it?

To find out, we sent questionnaires to most of the operating, or ready-to-operate, non-ferrous metal mines in the country. From the answers received, it is possible to form a reasonably clear picture of the present state of the industry.

All in all, the picture is not as dark as some alarmists would paint it. Although development is lagging in about half of the mines reporting, it could be brought up to normal in most of them within a year or two. It must be recognized, however, that not much increase in tonnage can be looked for unless extreme measures are demanded. Financially the industry is in good shape. More operators do *not* want loans for development than those who do.

Present metal prices seem adequate for maximum production from sources of most current output, but a majority of small operators need higher prices, particularly for lead and zinc.

Equipment was adequate at only 44% of the mines reporting, but 69% felt that as to methods, it is not feasible to mechanize further.

Manpower is without doubt a serious problem. The only pleasant aspect of it is that there is still time to do something about it. Neither large nor small companies are entirely free of some worry about manpower. The large companies stand out, however, because they are lagging behind the small companies in finding out what their manpower situation is, as regards the draft, for example. Before there is a real manpower problem in mining, both the industry and Government should take certain definite steps. These are indicated in both this and the following article.

What is your present monthly output of recoverable metals?

IN THE MATTER OF TONNAGE, we found that the answers we have received do not reveal any significant cleavage in opinion or situation between large mines and small mines. For the purposes of this report, large mines are considered to be those producing more than 1,000 tons of ore a day. Everything under that is considered a "small" mine in this tabulation to simplify the analysis of the data reported.

At any rate, small mines and large mines gave us pretty much the same sort of answers. There are few of the following questions on which one could have correctly forecast that all the large would be lined up on one side and all the small on the other.

By what percentage do you estimate that you can step up production and maintain an efficient operation for at least five years' duration, given adequate manpower, equipment, finances, and prices?

ESTABLISHED LARGE MINES, WITH TWO EXCEPTIONS, said they were already operating at a maximum efficient level. No additions of manpower, equipment, or finances could increase production, although some said they might build new facilities if some assurance could be given of a steady demand over the next five years.

There is no doubt that in dire emergency more production could be wrung out of this country's large mines, but at considerable sacrifice of efficiency and after considerable delay.

Small mines, on the other hand, seem more confident that capacity could be increased under the conditions set forth in the question. For example, many small mines reported that production could be increased 10% or more, some as much as 300%. Adding up their estimates, it appears that lead production could be increased around 10,000 tons per month and zinc output by 12,000 tons monthly from these small mines alone.

Any substantial increases in supply of copper will have to come from large mines or from new projects. There are very few "small" mines which are essentially copper producers. A few important new copper properties are in the development stage.

What is your estimate of the finances and terms necessary for you to achieve maximum efficient output?

INASMUCH AS MOST OF THE LARGE MINES reporting said that they were already operating at their maximum efficient output, they had nothing to say on financial help. In any event, most large mining companies are able to finance any development and improvement programs they wish to undertake.

There were two large projects, however, on which the companies concerned would need outside help. Here again, they did not rely on the Government to help, beyond suggesting that a suitable tax climate be set up that would encourage investment in mining enterprises.

A great many answers, in fact, expressed the same opinion, that if the tax structure were modified in line with the recommendations of the National Minerals Advisory Council, it would go far to simplify the financing of whatever expansion programs the indus-

try might wish to launch. Several operators said they would willingly invest quite large sums on marginal operations if the Government would, in turn, sign long-term contracts to buy the production at a fair price.

In any event, the thirteen mines reporting that they could put specific sums to work on expansion projects that would increase output within the next five years called for a total of $6,660,000. There was one other large-scale project in the planning stage that would cost $15,000,000. These figures do not include the many expansion and development projects that are currently under way in the industry; San Manuel, for example, or the new copper refinery of Kennecott in Utah.

Have you a normal amount of development ahead of production? If not, what percentage do you lack? What has prevented it?

OF THE TOTAL NUMBER OF MINES REPORTING 49% said they had development work up to normal; 51% were lagging. Here again, there was little difference between the situations of small and large mines. Large mines were divided evenly; small mines were about 60-40 on the side of lagging development.

Development seemed to be farther behind in the Coeur d'Alene area than in other districts, taken as a whole. This is undoubtedly due to the combined effect of low metal prices and manpower shortages, which hit the Wallace-Kellogg area harder than it did anywhere else, with the possible exception of the Park City district in Utah. Yet there were mines in both these districts that reported development up to normal.

Of those mines reporting a lag in development, 75% said they were 50% or more behind; 25% said they were 15% to 50% behind in development. In other words, where development is behind production, it seems to be greatly behind. This is true of large as well as small mines.

What is the reason? Low metal prices were blamed by 60% of those whose development work is behind. Government interference was blamed by 15%, and another 15% cited manpower shortages as the reason. Only 10% gave financial troubles as the reason, although this element might well be tied up with low metal prices. Certainly the price plunges of last year brought plenty of financial troubles to metal mines.

Obviously, many mines have worked near miracles in bringing their development work up to normal so soon after the war. In several cases, this has been done by deliberately sacrificing profits. Even though about half of the mines seem to be in good shape on development, the industry as a whole is in poor position to meet an emergency.

Is it feasible to expand development, either to meet a future manpower shortage or to expand production? If so, for which purpose? How long would it take?

MOST MINING COMPANIES (70%) said it was feasible to expand development work; 30% said it was not, or that it was unnecessary. Of course, those who are not doing it must attach certain conditions to this statement, because if it were feasible to expand development as things now stood, there would be more than 49% of mines reporting normal development.

Development could be expanded to increase production, in the opinion of 65% of the mines answering this question; 11% could expand development to relieve a future manpower shortage; 24% said it could be aimed at both.

Any significant expansion of development would take 5 years or more at 16% of the mines reporting. It would take 1 to 5 years at 64% of the mines, and less than 1 year at 20%. There was no marked difference between small and large mines in this respect. Differences in orebodies and local situations probably have more influence than size of operation.

On the loan question, 64% of the mines gave a flat "no." The assumption was that the Government would be the most liberal lending authority from here on, and this return shows a healthy independence on the part of even those operators who face closed mines or the grimmest of balance sheets. Loans to increase development work would be welcomed by 31%, and 5% of the mines said "maybe." One hard-working operator replied, "No, thanks. Just give us a tax climate we can live in."

Are you equipped for the maximum scale of production that you can attain efficiently? If not, what equipment do you lack? 1. Capital items? 2. Maintenance items? 3. Supplies?

EQUIPMENT IS LACKING in 56% of the mines reporting; 44% reported themselves as equipped for the maximum scale of production they could hold efficiently. Capital items were most needed, running the whole gamut of mining from rock drills to filters. Compressors appeared perhaps more frequently than anything else, rock drills and flotation machines were next.

Maintenance items were mentioned less frequently, and there seems no difficulty in getting supplies.

If loans and equipment are available, will you be likely to invest importantly in new equipment as a bulwark against an anticipated man-power shortage?

IN VIEW OF THE FOREGOING STATEMENT that 56% of mines reported themselves in need of equipment, it may seem strange that 69% of them said they would not be likely to invest in new equipment as a precaution against a manpower shortage.

The reason for this difference is, of course, that so many mining companies feel that they have already taken most of the important steps toward installation of labor-saving devices. The common attitude is that there is little more that can be done toward making machines do the work instead of men.

Have you, or can you secure, adequate manpower for emergency requirements? By what percentage will it cut your production to lose men: 1, now in military reserves; 2, now under age 26? If you need more men, where, in your opinion, should they come from?

MANPOWER IS LOOMING UP as the No. 1 problem in any emergency with which the mining industry has to deal. Right now, the manpower problem is restricted to a few districts. But if the Government does not take precautions to prevent the loss of manpower by the country's strategic and critical mineral producers, the industry is likely to be severely handicapped in its vital part in the defense effort.

Briefly, this is how the manpower situation looks in several of the country's leading mining states or districts:

Arizona. Needs miners, timbermen, mechanics, electricians. Plenty unskilled labor available. Mines feel draft will be no problem because the draft boards will understand essential nature of mining.

New Mexico. No shortage of men as yet. Mines reopening at various camps taking up a recent slack in employment in mining. Biggest demand for skilled

underground workers. Probably just about balance supply and demand for men if nothing upsets situation.

Utah. Situation obscured by strikes. Men available as a result that would otherwise be working. Mines that are running have no difficulty getting men, and do not expect any. Hope is that draft boards will use discretion in taking men from mines. Several mines have developed training programs in expectation of having to bring in replacements if manpower becomes a problem.

Nevada. There is ample manpower, and no trouble is expected.

Montana. Butte has been advertising for hard rock miners all over the West and is gradually building up its crews. Elsewhere in the state there seemed to be no trouble expected, although uneasiness noted by some.

Coeur d'Alene. The Wallace-Kellogg area is short about 500 experienced miners. Recruitment for the Puget Sound Navy Shipyard is drawing away men. Other Government projects in the area have their effect as well. Wages on such projects are higher than mines can match. Also, Government projects upgrade men in job titles to bring them to the job.

Northwest. Operators are worried by prospect of draft and Government work taking men. Many miners seem to be afraid of being frozen to job and therefore keep moving even though job may be satisfactory. Others look for nice jobs at high pay in Government plants, feeling that it will be regarded as more essential than mining. Shortage of underground miners being felt.

In the East, there seemed to be no immediate difficulty. But here, as in the West, skilled miners are not easy to find.

But there will be a manpower problem. This is inevitable, unless the Government and the industry combine to prevent it. All Government construction jobs, except the most essential, should be stopped. Wage scales ought to be held in line with area levels. Pirating of men for Government work ought to be stopped, or at least Government recruiters ought to keep out of mining districts. Skilled miners ought to be declared essential and draft-exempt. The problem ought to be met before it develops, and the time to do it is right now.

Of the mines answering our questionnaire, 55% thought they could get the manpower they needed for emergency requirements. This figure ought to be taken with some reservation, because the manpower pool would drain away with surprising speed in a real emergency. It did the last time, and it would go faster this time.

With regard to potential losses to the military, 16% of mining companies answering thought they'd lose 10% or more of their production if men in reserve status were called. A 1% to 10% loss was forecast by 5%, 7% thought they'd lose nothing, and 72% didn't know what would happen. Drafting men under 26 years of age would cost more than 10% of production at 25% of the properties reporting. It would take 1 to 10% at 18% of the mines, 4% expected no lost production, and 53% didn't know.

Here are some typical comments on the manpower situation offered by mine managers:

"I cannot sufficiently express the importance of leaving the men, skilled and trained in the particular work pertaining to mining on the job here, and for the Government not to lure them away to other defense jobs. Men are already leaving here with the promise of better wages on the West Coast, and I feel that we are going to have a repetition of our experience in World War II."

"Experienced manpower is not available. A training program will be required."

"Manpower should be allocated by some authority."

"Stop construction on the Grand Coulee Irrigation Project, which is certainly not needed at this time, to relieve the manpower shortage in the mines."

"Men in the mining industry should not be called by the draft."

"After the men are gone, it is too late to do anything about it. Unrestricted pirating of labor by Government contractors with wage scales at higher than local rates will cause serious shortages."

If wages do not change, what metal prices do you estimate will be necessary for you to attain maximum efficient production?

Here was an opportunity for mining men to expand on a favorite topic if they chose to do so. The sky might well have been the limit when mine operators began thinking about what prices they'd like to be getting for their metals.

As it turned out, the estimates were quite restrained. The averages of all the estimates were: copper, 23c.; lead, 15¾c.; zinc, 16¼c. The highest estimates were: copper, 28c.; lead, 23c.; zinc, 20c. The lowest estimates were: copper, 21c.; lead, 13c.; zinc, 15c.

One mercury producer thought that the price should be $125 to $135 per flask. Another experienced operator reported that the industry as a whole would have to get about $300 per flask in order to boost production to the World War II level of 60,000 flasks per year. He estimated that it would take at least three years to get production up to that level.

For antimony, it was estimated that domestic production could be increased from the present 1,500 tons per year to about 9,000 tons per year if the price were increased to 40c. per lb. Production at the higher level of output could be reached in about one year.

A manganese producer estimated that his current production rate could be maintained steadily with a price increase or premium of $10 per ton of concentrates to be applied exclusively to exploration and development work.

For molybdenum, it appears that prices would have to be slightly higher than current to maintain maximum efficient output.

It should be borne in mind, however, that these estimates did not contemplate wage hikes which are almost certain to be demanded.

Clearly most operators, large and small, feel keenly that they can get along without Government aid or interference, but must have a tax climate favorable to investment and prices which reflect the high wage levels which labor, with Government help, exacts from them.

To further clarify the answers to the above question, it should be noted that those who replied that "present prices" were adequate (about 25% of the reporting mines) were basing their estimates on 12c. lead, 15c. zinc, and 22½c. copper. All three have gone up since.

Acknowledgments

E&MJ expresses its sincere thanks to the numerous mining companies who have replied so generously and promptly to this request for vital mining information.

Precautions Against Full-Scale War

1. **Build stockpiles aggressively.**
2. **Promote long-range exploration and development.**
3. **Undertake research into development of low-grade deposits and substitutes for strategic materials not likely to be available in wartime.**
4. **Create backlogs of extra development, extra mechanization, training programs, and if possible, personnel.**
5. **Erect standby plants and facilities in anticipation of war damage.**
6. **Take precautions against sabotage.**
7. **Foster production of strategic and critical materials in friendly foreign countries.**

Americans must wake up to the fact that, if they love liberty as they say they do, we can no longer temporize with the problem of defense against communist aggression. Probably we are headed for a long, grueling ordeal, one that will really test our character and belief in free institutions. For the mining industry's part in the defense of civilization, E&MJ offers this program.

A Mining Program to

THE AMERICAN PEOPLE are again entering a conflict unprepared, in a world where all available evidence points to the fact that never again will we have a year or two to mobilize while someone else dies at the ramparts.

Is there any excuse for being unprepared? Is the foe unidentified? Is he failing to prepare? Does he lack courage, shrewdness, training, mechanical skill, or manpower? Does his determination to destroy us flag? No, no, no!

To those who would take heed, the Soviet leaders for thirty years have made no secret of their convictions that their kind of society and ours cannot live in the same world together, that a death struggle is inevitable, and that they intend to triumph. As a matter of fact, for most of these thirty years they have maintained a clearly recognizable fifth column in our midst, bold enough to publish its views and intentions, and to demonstrate over and over again its complete subservience to Moscow. That fifth column has reached into our most secret files, planted its agents at the elbows of our highest officials, and stolen our most strategic secrets. Still Korea found us unprepared even for a sideshow conflict! All the evidence of Russian duplicity since Yalta had not taught our Administration to warn the people, even on a recent Presidential tour to "give the people the facts." Even Pearl Harbor and the surprise of Manila had not taught our high command to be alert.

In an age of atomic weapons, to be so infiltrated and unprepared is to invite disaster, conquest and slavery!

Let us hope that Korea has taught us and our leaders a lesson and that henceforth we will not ignore the determination, ruthlessness and strength of the power which has dedicated itself to our destruction. If anything can prevent a holocaust which almost certainly would wreck civilization, it will be our building up and maintaining, either on our own or under United Nations auspices, a defensive force sufficient to make further aggression by communist powers look decidedly unprofitable. This will be difficult and expensive, particularly for a long pull, but it seems to be the only basis on which we can preserve a social order based on individual independence.

It seems unlikely that the Soviet dictatorship intends to foment full-scale war at this time. Such evidence as we have suggests that they have not the food production, industrial development, or stockpile of atomic weapons to warrant such a move. Moreover, a ruthless aggressor will not overlook the advantage of surprise attack. If the reds intended a full-scale conflict, they would have utilized the element of surprise in an attack on Western Europe, and would at least have had the Ruhr by now.

Exploiting Our Weakness

Probably a compelling reason why the communists do not want all-out war at this time is because they have a most advantageous alternative, one which cleverly used may very well gain their end without wholesale destruction, either of their own vital centers or of the prizes they seek. This alternative is to infiltrate, undermine and harass the outside world, never going beyond the type of puppet conflict now being fought out in Korea. This is a technique at which they have proven to be masters and against which our defenses are pitiably inadequate. It is cheap to them and expensive to us. By infiltration of a thousand accomplished trouble makers they can stir up enough disorder to engage at least twenty-five times that number of policemen. They can con-

Steps to Combat Puppet Warfare

FOR INDUSTRY

1. Modernize and mechanize operations, pull up lags in exploration and development, eliminate operating bottlenecks.

2. Promote labor-management harmony, improve working conditions, and give workmen the economic facts of life.

3. Firm up organization to meet added demands and possible losses of key men and manpower.

4. Root out communists, and make the community aware of their penetration and the menace they present.

5. Develop substitutes for scarce items.

FOR GOVERNMENT

1. Tax to prevent inflation, while preserving incentives to investment and greater effort.

2. Encourage exploration, development and production of strategic and critical materials.

3. Apply such controls as are needed, but make them self-eliminating.

4. Avoid manpower drains that would cripple a basic industry, vital to defense.

5. Get rid of red influences in Government, and help industry kick out communists.

Defend Civilization

front us with difficult and embarrassing management problems, and exploit the circumstance that it will be our forces that are formally identifiable on foreign soil. They can force us to a $60 billion annual budget—itself a powerful menace to free institutions—and to the maintenance of a good sized standing army. Such a situation, particularly if of long duration, can be more trying to the unity and morale of the Western world than a full-scale effort. Taxpayers will grumble, individuals will tire of shortages and controls, and mothers will besiege Congressmen to let their boys come home, particularly during periods between outbreaks.

That the American people have the fortitude to meet such a situation can hardly be doubted, but success will call for continued education as to the reality of the menace and the existence of infiltration. Puppet warfare may last a generation or more and our greatest risk will be our chronic tendency to overconfidence and unpreparedness.

Dramatizing Intangibles

There is another important side to the struggle, an ethical or spiritual side. Oddly enough, although nearly all the natural advantages are on our side, the reds are able to capitalize heavily on our denial of equal rights to minorities, our underprivileged groups, and any exploitation of workers. They may have 15,000,000 or more prisoners in concentration camps, but that is remote, and the seeker after social justice is likely to be more impressed by lesser abuses nearer at hand. Also, Americans are likely to discuss their advantages in material terms, so that much of the rest of the world tends to regard us as barbarians with bathrooms. We have a real obligation to identify and dramatize more effectively the spiritual values of democracy. There is more to a society based on individual independence and incentives than maximum production of goods and services, but we frequently seem to forget the other values. A greater abundance of material benefits, freedom to think, and freedom to speak, and freedom to select a preferred vocation, develop much more intellectual fruit than a society dominated by a party line buttressed with bayonets, but we hear little enough of the contrast, and to a great many it is not evident.

Impact on Mining Will Be Strong

TO GEAR FOR A LONG PULL of puppet warfare and at the same time take adequate precautions against an eruption into full-scale conflict will have a profound impact on the mining industry. It is to be hoped that Government will profit from the experience of the last war and not strip the industry of the manpower necessary to do its job. Also, for a long pull it would be folly to gain production by the neglect of development and modernization programs. In fact, the outlook calls for abnormal efforts in these directions as a precaution against all-out warfare.

Obviously there will be an intensified demand for the products of mines, particularly from producers of critical materials and of strategic materials not available elsewhere. The diplomatic problem of Western-world unity will continue to overshadow the desire of the domestic industry for protection against competition, but the need for added supplies is likely to create conditions where the pressure for protection will subside.

It is certain that the industry, and all individuals in it, will have to pay much higher taxes. Nevertheless, it also seems certain that in one way or another the Government will have to put back into mining at least as much as it takes away. This may be by purchase contracts, by furnishing access roads and other facilities, by development loans, advances against production, loans for modernization, standby facilities or surplus development, and in the case of short commodities and price controls, special assistance to spur production.

To what extent will controls enter the picture? No one can predict, but it seems certain that some will be applied to items in such short supply as steel, copper and zinc. Controls will spring either from the inability of defense contractors to acquire needed materials, causing allocation, or by shortages driving prices to heights which are deemed dangerously inflationary or which provoke public irritation.

Controls Breed Controls

Many people seem to hope that sellers can avoid the need for controls by doing a certain amount of allocation individually and by a restrained attitude on prices. In our opinion, these hopes do not reckon adequately with the anti-trust laws or with the inevitable tendency of sellers to favor established customers. To control short commodities by private measures could only be done by such cooperation among sellers as would violate anti-trust statutes. The laws forbidding collusive fixing of prices apply as much to holding them down as to raising them. Individual action by sellers might succeed where the forces to be controlled are very weak, certainly not where they are strong.

Partial allocation of short commodities will cause strong upward pressure on prices as non-preferred users scramble for the free supply. This is likely to invoke price control which, combined with shortages, will invite black markets, which in turn will call for full allocation. All experience during the last war led to the conclusion that to interfere with any aspect of the price-supply-demand balance causes reactions whereby controls breed controls. If we expect to forestall inflation, we must expect to allocate the full supply of a short commodity at a controlled price and subsidize productivity. Otherwise, we must leave the markets completely free to develop their own equilibrium, resigning ourselves to the inflationary results as uncontrollable.

Conceivably controls of a few short commodities can widen into control of more commodities and into complete regulation of wages, prices, manpower, profits and labor disputes unless administrative bodies act wisely and with restraint. Even an expanded tax program, long continued, can undermine our private enterprise system unless the program affords special incentives to investment and to the worker who makes an extra effort.

Production Incentives Needed

If price ceilings come, subsidies to stimulate added production will not be far behind. These, however, need not be in the form of a renewed Premium Price Plan. They can take the form of purchase contracts or advances against production, treating each case separately on its own merits. Nevertheless, keeping in mind that a Government spending taxpayers' money must treat all citizens alike, it is obvious that wherever business is done with a large number of people, an administration must develop formulas on which to base its decisions. In other words, a system of individual contracts is likely to widen out into a broad subsidy plan.

Considering not only the present tax deterrents to long-risk investment but added tax burdens, it seems evident that something must be done to stimulate exploration, surplus development, maximum mechanization, process research on strategic materials which are abundant in this country only in low-grade deposits, and research seeking substitutes for strategic materials not abundant in any usable form in this country. All of these activities have a logical place in a program to combat puppet warfare.

Will gold mining be curtailed? Probably not, except to the extent that price and wage inflation act as curbs. Conceivably in due time the dollar price of gold may be raised, but there is no present prospect of this. Meanwhile, if there is any move to restrain gold mining, the gold miners should stoutly insist that such policies should apply equally to all industries rated as non-essential.

Curb the Communists

An important problem that must be met is the infiltration of communists into the mining industry. Naturally, they will try to increase their penetration into such a potent factor in our scheme of defense. Even if they do not increase it, mining has the unfortunate distinction of being one of the few industries wherein a communist-dominated union still operates. It is a challenge to every employer who still deals with this union to ask himself why his employees trust him less than they trust servants of an unfriendly foreign power. It is a challenge to Government to root out the red influence in Government agencies. In either Government or the mining industry, communists are in a favored position to endanger the nation's security or to sabotage key functions when word is passed from Moscow.

The Part of Government

WHETHER THE FUTURE BRINGS WAR or puppet warfare, there can be no doubt that the gradual drift toward socialism that we have been experiencing for several years will be given a strong impetus. To retain a system based on individual independence and private initiative will call for much more than mere conversation by its advocates. Apart from such controls as may be instituted and the anticipated increased dependence of small business on Government aid, the size of the tax burden that may have to be borne for the indefinite future will gradually exterminate private enterprise unless special incentives are provided.

A generous flow of earnings and savings into investment in new enterprises is absolutely basic to a successful capitalistic system. The tax laws simply must afford incentives to the investor proportionate to the risk he assumes. This clearly implies continuation of a preferred status for capital gains and avoidance of double taxation on corporate dividends. Also, measures should be taken to encourage insurance companies, with their huge aggregations of public savings, to enter the risk-capital field.

In our opinion, we can no longer afford politically easy solutions to the tax problem. It is up to the politicians to attack inflation on a

realistic basis instead of merely talking about it and doing little. A realistic basis would mean to stop adding to investment deterrents by steeper graduations on high-bracket income taxes and by higher corporation tax rates, and to derive a much larger share of Government income by excise taxes on scarce commodities. This would have the double effect of reducing demand for short items and soaking up purchasing power where it produces the most inflationary effects. The present Administration tax program may be politically expedient, but it will do little to curb inflation. The latter now becomes a menace that must be faced, or the consequences will be serious.

Work Incentives Wanted

Discussions of tax policy have generally overlooked the facts that a successful capitalistic system depends as much on the individual willing to do a better job as on a continued flow of new investment. We suggest, therefore, that the tax laws should give a preferred status to earnings from overtime work. It may take much overtime work to solve the problems we face, and the accepted method of compensation by time and a half or double time for overtime imposes such inflated costs on employers that it operates essentially as a deterrent to overtime working rather than as an incentive. If the Fair Labor Standards Act could be suitably amended, and the tax laws would permit a larger "take home," it should be possible for industry to negotiate compensation levels that would make overtime working more feasible.

With the background of the low tax rates that have applied to smaller incomes in the past, this suggestion may seem unrealistic. However, it is made in the belief that opportunities to soak the rich effectively have been exhausted, and that any large increase in tax rates must affect the whole earning population.

It will be Government's job to apply controls to the economy to the extent necessary to assure success of the defense effort, and to prevent dangerous inflation, profiteering, hoarding, black marketing, or disequilibration of industry. This will be an unpopular function but one calling for great administrative skill, so that controls will function to cure themselves as much as possible. To an unimaginative or bureaucratically ambitious administration it will always seem easier to shore up controls with new controls. To protect themselves, industry and the public should insist that control policies should include measures for self-alleviation. For example, if price control is applied to steel, copper and zinc, the control system should incorporate some method of restoring the balance between supply and demand through adequate incentives to increased productivity or toward substitution.

In addition to such incentives as intelligent taxation should provide, it seems certain that Government will have to set up some form of financial assistance to encourage productivity of scarce materials, particularly in the strategic and critical categories. These could take the form of development loans or advances against production, after suitable scrutiny, with repayment contingent upon successful results. To the extent that Government needs the materials, long-term purchase contracts are effective, and frequently enable a competent operator to secure his financial needs through private channels.

However, if the need for added scarce materials exceeds requirements for stockpiling and defense contracts, it will probably become necessary to set up a system of direct subsidies that will let these products flow through normal channels to market rather than being bought and resold by Government.

Non-Discrimination Urged

In our opinion such a system would be infinitely more efficient if applied to all production of the desired commodity, than merely to production in excess of an arbitrary base, or even more selectively as was done under the Premium Price Plan. A selective subsidy system is a wide open gate to Government control of an industry, is administratively burdensome, provokes dissatisfaction, unbalances the industry, and in due time will remove the spurs to increasing efficiency which competition provides. The inevitable objection to enriching low-cost producers or paying more for production already in being can be adequately met by suitable excess profits taxation.* A simplified subsidy system would be simple to administer, would encourage the industry to employ efficient methods, would enable a logical distribution of scarce manpower, would maintain the industry's equilibrium, would have a deflationary influence on prices, and would not promote the encroachment of Government into the industry. It would be much less provocative of discontent than a discriminatory arrangement and would tend to keep mine operators mining their properties rather than "mining in Washington."

*The Administration has already indicated its determination to restore excess profits taxes.

Precautionary Steps

Keeping in mind that we are probably headed for a puppet war which may break over into full-scale war at any time, it is evident that we have a dual job. This is to meet the increased demands of a reduced-scale conflict, possibly of many years duration, and at the same time to take precautionary steps against a major eruption. For the last purpose the following measures by Government would be realistic:

1. To build up an adequate stockpile of strategic and critical materials more aggressively than in the past.

2. To finance in whole or part research into utilization of strategic materials which occur in abundance in this country but in low-grade deposits. This research should go beyond the pilot-plant stage to the installation of at least one full-sized plant for each large deposit.

3. To finance in whole or in part research into substitutions for scarce materials, particularly those for which we are essentially dependent on foreign sources that may be cut off in an emergency.

4. To finance a large portion of the cost of exploration for scarce or potentially scarce materials, on the basis of a competent scrutiny of the proposed activity and liability for repayment limited by the success of the effort, if performed in good faith.

5. To finance, on realistic terms, surplus mine development of war-essential materials, repayable out of a fair fraction of production when realized. This would be a precautionary step against recurrence of the lag in mine development which resulted from manpower shortages in World War II, and which would have been a serious impediment to productivity had the war lasted longer.

6. To finance, on realistic terms, maximum mine mechanization in situations where it would become useful in case of manpower shortages, although not amortizable under current conditions.

7. To finance surplus equipment, plant or facilities involving war-essential materials, or plant dispersals, as precautions against sabotage or war damage. It is folly to presume that we can go through another great war with our industrial plants and population centers unscathed.

8. To stimulate, by purchase contracts and advances against production, the production of strategic and critical materials in friendly countries, particularly in countries likely to remain accessible in case of war.

Root Out Communists

The Communist Party is a dagger aimed at the vitals of the United States and all other non-communist states. To root it out from its present penetration of key spots and to exterminate it as long as it remains the tool of a foreign power is an obligation in which Government has a large share. Government must dislodge communists and communist sympathizers from Government agencies. It must refrain from converting communist investigations into political issues, and conduct these investigations on a basis which any loyal American can understand. It must strive to eliminate conditions, such as race discrimination and lack of equal opportunity, which enable communists to gain a foothold among depressed elements in our society. It must cooperate with industry and labor to aid honest efforts to throw communists out of industry and labor organizations. To continue to permit these spies and traitors to take advantage of our free institutions, to steal our strategic secrets, pervert our educational system, and prepare for fifth-column activity in the event of war would be stupidity beyond all comprehension!

The Mining Industry's Role

THE MEMBERS OF THE MINING INDUSTRY, with its vital part in defense measures, face a much larger responsibility than simply making profits for stockholders or earnings for themselves. The function which is implicit, that of providing for essential needs, must be pulled up to the forefront either to parity with, or to take precedence over, the stewardship of owners' financial interests. Even in the most selfish sense, no owner or no individual has any security apart from the security of the United States in a struggle against the communist dictatorship.

The main job is to gear for maximum but balanced productivity, by pulling up any lags in development, by mechanizing to the fullest extent feasible and otherwise modernizing operations, by eliminating operating bottlenecks, by composing labor differences, by improving working conditions, by sharpening safety and health programs, and by organizing management to meet manpower drains, particularly where reserve officers are concerned.

These are typical operating functions, realizable in most instances through private finance. There are certain precautionary activities partly attainable through private financing, but wherein the operator may have to seek Government assistance. These include:

1. Surplus development, beyond the point clearly amortizable, including development of low-grade reserves for emergency purposes.

2. Creation of standby installations, as precautions against sabotage or war damage.

3. Special measures to eliminate sabotage by moving, dispersing, shielding, or fencing.

4. Development of emergency training programs if the operation is large enough to warrant it.

5. Development of substitutes for scarce or potentially scarce materials.

The individual mine operator has an important part in the job of cleaning house of communists. He must learn more about them and their local activities. He must help awaken the local community to the menace they present. He should inform the FBI of their existence, taking care, however, to distinguish between communists and mere radicals whose loyalty is not questionable. He must eliminate communists from strategic positions in his organization and help the local labor union throw them out. He must lean over backwards to do his share to eliminate the grievances, industrial or social, which give communists a local foothold. Communist propagandists are very clever at identifying profit with greed and management with exploitation. Nothing could discourage them more at the local level than management policies whose fairness is evident to all, and efforts of management to make employees understand the economics of operation and the size of their own "cut" out of gross income.

A Task for All

We are facing a crucial test in our national life, one which may test our loyalty and steadfastness far more than a full-blown but shorter emergency. We may have to take punishment, real punishment, for years and stand up under it, without the emotional stimulus of wholesale death and destruction. Facing this prospect, every one of us has an individual obligation to serve when called upon and to restrain criticism to the point where it will not disrupt unity. The last is not easy. All leaders have their shortcomings, all of us are influenced by political philosophies, and hindsight is so clarifying as to mistakes already made. Criticism must be preserved; it is vital to democratic progress, but it can be overdone, particularly when facing an enemy adept at subversion.

While learning to appreciate more the ethical and spiritual values of our way of life, in contrast to the straightjacket thinking and machine-gun rule of communism, we must proselyte our views to our children, neighbors and fellow citizens. We are sure that you will be shocked when you try this on finding out to what extent communists have infiltrated your local community.

Protect Achilles' Heel

Above all, as individuals we must strive to restrain the over-confidence which has caused us to be caught napping by every emergency in the twentieth century. We must not forget that the communists have taken most of the tricks in recent years, that their devotees have fanatical zeal, and that to be caught napping during an atomic age is likely to be disastrous. Too many of us, despite all the evidence that the menace is real, still seem to cherish the idea that let these commies continue to act this way, we'll some day get tired of fooling around and let them have it, the implication being that whenever we choose to do this, the job will be easy.

To wait until some day, or to fall asleep again, can be our undoing. It must not happen, whatever the sacrifice.

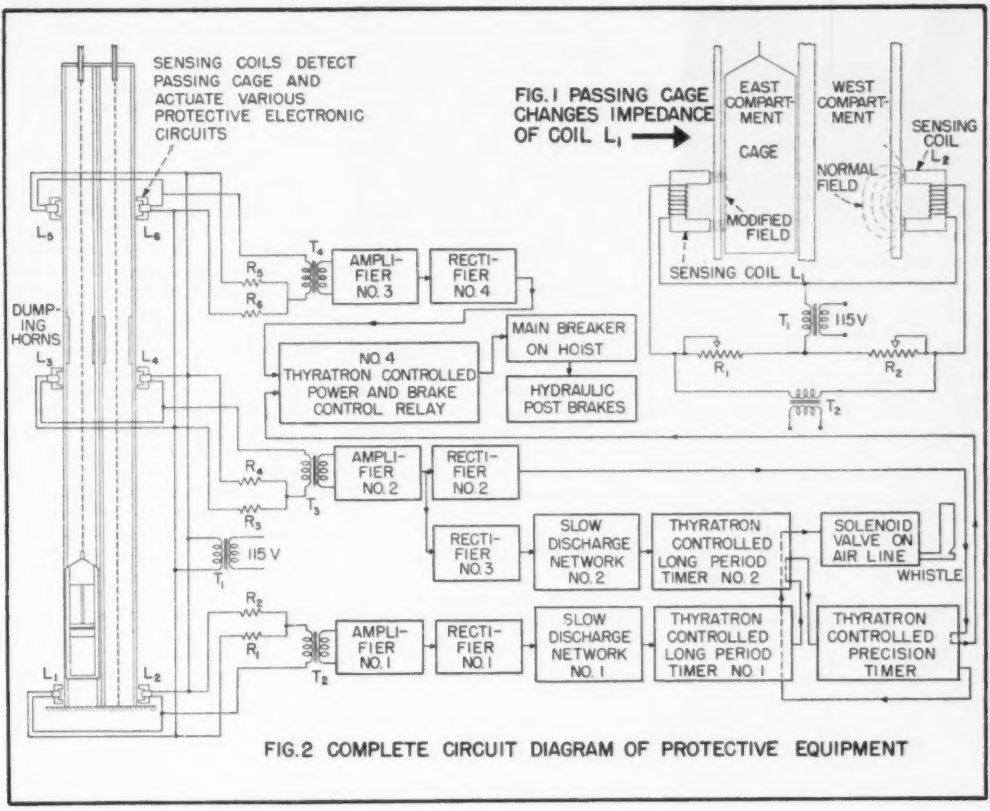


FIG. 2 COMPLETE CIRCUIT DIAGRAM OF PROTECTIVE EQUIPMENT

New Hoist Protective Device Prevents Overwind, Overspeed

No mechanical contacts or electric eyes are needed in Mr. Marquardt's device — just sensing coils which actuate protective circuits when a cage passes by and changes the impedance of the coils.

C. M. MARQUARDT[1]

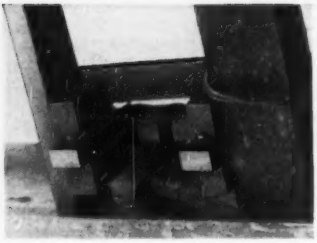
OVERWIND PROTECTIVE equipment at the Caselton hoisting system of Combined Metals Reduction Co., Pioche, Nev., is unique because it uses the change in impedance caused by a passing cage or skip to warn the hoistman of excessive speed as the cage passes the collar of the shaft. If the warning is unheeded, the device will stop the hoist and set the brakes. The unit will also prevent overwind or starting the hoist in the wrong direction after the skip is backed out of the dump.

Hoisting equipment at the shaft consists of a double-drum Nordberg hoist driven by a 200-hp. ac. motor, manually controlled from a drum switch. Brakes are hydraulic post type. Hoisting is in balance. Skips are permanently mounted below cages.

Headroom above the skip dump at the Caselton shaft is only 10 ft. This makes it practically impossible to use conventional protective systems, to overcome the inertia of the hoisting equipment in time to prevent damage. Although no overwind mishaps occurred at Caselton for several years, two accidents caused damage to the skip and dump structure within a period of two months after production had been increased.

It was recognized that electronic overwind protective devices under consideration would have to per-

[1]Electronic Engineer, Combined Metals Reduction Co., Salt Lake City, Utah.



SENSING COIL mounted in skip road

form the following functions:

1. Sound a warning as the cage passes the collar of the shaft on its upward trip to remind the hoistman to operate the controls so that the skip will not enter the dump too fast.

2. The warning whistle should not normally be sounded when the cage returns down the shaft.

3. The unit should actuate devices which cut off the power and set the brakes if the skip enters the dumping position at excessive speed.

4. The unit should not operate as the skip makes its downward trip after dumping.

5. The unit should prevent the cage from traveling appreciably above the skip dumping position regardless of what speed it is traveling. The purpose of this is to prevent the hoistman from hoisting the cage-skip assembly past the dump and into the head sheave at low speed, or from starting the hoist in the wrong direction and "backing" into the sheave.

6. The unit should be "fail-safe," i.e., it should set the brakes and cut off the power if any part of the device fails. In such emergencies means must be provided to by-pass the protective device and hoist without its benefit.

7. A simple means of testing the operation should be provided.

Mechanical Contacts Avoided

At the outset the use of a switch or device on the hoist dial was ruled out because of the precision necessary, and the fact that changes in the cable such as stretching would require frequent adjustment. Mechanically operated switches or rubbing contacts actuated by the passing cage were also considered impractical because of continual maintenance and inspection requirements. Experience with phototubes indicated that they would not be satisfactory because of interference caused by snow, dust and bugs obstructing a light beam.

Consequently it was decided to let the passage of the cage near a coil cause the variation in impedance of the coil to unbalance an electrical bridge unit. See Fig. 1. Briefly, coils L_1 and L_2 and resistors R_1 and R_2 form a Maxwell bridge which is fed alternating current by the power transformer T_1. The relation between L_1, L_2, R_1 and R_2 for balance of the bridge is as follows:

$$L_1R_2 = L_2R_1$$

$$\text{or} \quad \frac{L_1}{L_2} = \frac{R_1}{R_2}$$

By adjusting the values R_1 and R_2 when skip roads opposite the sensing coils L_1 and L_2 are both clear, it is possible to balance the impedance bridge. For best results the inductance of coils L_1 and L_2 should be as near equal as possible. When the bridge is balanced, no voltage appears across the secondary of transformer T_2. Any change in impedance of L_1 or L_2, as will be the case when a cage passes either coil, results in bridge unbalance, and an alternating voltage appears across the secondary of transformer T_2. The voltage across the transformer secondary with the cage opposite L_2 is 180 deg. out of phase with the voltage that appears across the secondary when the cage is opposite L_1.

Bridge Offers Advantages

The bridge circuit serves as the sensing means for the protective device. As designed it offers many advantages for sensing the passage of the cage. For instance, properly wound coils are free from the effects of insects and weather, and can be protected from spills and falling objects. As no physical contact is made with the cage, there are no moving parts requiring inspection and maintenance. Voltage impulses from the sensing coil serve as a motivating means for the protective device, which prevents overwind and forces the hoistmen to govern the dumping speed manually.

As the cage is often stopped at the collar of the shaft, it was obvious that a system of interlocking or sequencing relays could not be used to prevent the warning whistle from blowing on its downard trip. As such an arrangement would get out of sequence and fail to give proper protection, a means had to be provided for automatically resetting the protective device so that an upward passage of the cage past the sensing coils at the collar would always sound the warning whistle regardless of whether the cage was stopped at the collar or was taken into the dump.

Fig. 2 shows the circuit chosen to accomplish the desired control.

How It Works

When the cage travels upward in the east shaft compartment and passes coil L_1, the impedance bridge is unbalanced and an alternating current appears across transformer T_2, which is amplified by amplifier No. 1, rectified to dc. by rectifier No. 1 and charges slow discharge network No. 1. The ac. voltage applied to slow discharge network No. 1 causes thyratron-controlled long-period timer No. 1 to actuate for a period of about 5 sec. after the cage passes coil L_1. This long-period timer serves primarily as a means for controlling a second thyratron-controlled timer which we shall call precision timer. This unit will precisely measure time intervals to an accuracy of 0.01 sec. over any preset time interval up to 5 sec. The precision timer actuates a shrill warning whistle. It also switches the grid connection of thyratron No. 4 from a positive source of voltage to rectifier No. 2 which is associated with coil L_3. Thyratron No. 4 energizes the coil for the final power and brake control relay.

Coil L_3 is situated just below the dumping position in the headframe. When the precision timer completes its timing cycle it switches the grid of thyratron No. 4 back to the source of positive voltage. This source of positive voltage insures that thyratron No. 4 is firing at all times when the cage is not in the vicinity of coil L_3.

If there is a signal from coil L_3, as will be the case when the cage passes it, the signal is amplified by amplifier No. 2 and rectified by rectifiers No. 2 and No. 3. The output of these rectifiers is negative relative to ground potential. If the hoistman has controlled the speed of the hoist properly, the precision timer will have completed its timing cycle before the cage is opposite coil L_3. The grid of thyratron No. 4 is thus disconnected from rectifier No. 2 before the signal (due to the passage of the cage past coil L_3) is received by this rectifier. Thyratron No. 4 does not cease firing, and the final power and brake control relay is not actuated.

If the hoistman fails to properly control the speed of the cage from the time it passes coil L_1 until it reaches coil L_3, however, the pre-

cision timer will not have completed its timing cycle, and the grid of thyratron No. 4 will be connected to the output of rectifier No. 2. The signal from coil L_3 being amplified and rectified results in a high negative voltage being applied to the grid of thyratron No. 4. This tube ceases to conduct instantly, de-energizing the final power and brake control relay, resulting in stoppage of the hoist.

Output of rectifier No. 2 is not fed to a slow-discharge network with the result that thyratron No. 4 ceases to fire as soon as the cage passes coil L_3, and the hoistman may "pick up" the power and brakes. The final control relay immediately resets itself.

On its downward trip the cage passes coil L_3, resulting in a signal to rectifiers No. 2 and No. 3. Since the precision timer has run down, the output from rectifier No. 2 does not have any effect on thyratron No. 4. The output from rectifier No. 3, on the other hand, is fed to a slow discharge network which is instantly charged to a high negative potential, causing thyratron-controlled long period timer No. 2 to actuate for a period of about 10 sec. This opens the circuit to the precision timer, preventing it from going through its timing cycle for this period of time. When the cage passes coil L_1 on its downward trip, long-period timer No. 1 is actuated, but it cannot actuate the precision timer. Thus the whistle cannot blow on the downward trip of the cage.

After 10 sec. have elapsed, both long-period timers No. 1 and No. 2 have completed their timing cycles, and the apparatus is ready for another passage of the hoist on an upward trip. As it is almost impossible to stop and reverse the hoist in this period of time, the apparatus may be considered ready to protect against overwind at all times.

Top Coils Prevent Overwind

Coils L_5 and L_6 prevent the cage from traveling too high in the headframe at a reduced speed or from being "backed" into the head sheave. Any time the skip passes these coils the main power breaker is opened and the brakes are set. As the cage cannot pass the dump except at reduced speed, the inertia of the hoist will not carry the cage into the head sheave when the power is cut off and the brakes are applied. The cage in the west compartment of the shaft in passing coil L_2 and L_4 causes operation of the protective device in a manner identical with that already described.

Considerable attention was given to making the device fail-safe. For instance, if failure of some component of the circuit should occur, then the brakes should be immediately set and the power cut off. To accomplish this, the tubes comprising the electronic circuit were so chosen that all filaments require the same current. The filaments were connected in series so that failure of any filament will open all filament circuits, causing complete shutdown. The circuit was so designed that all tubes were operated below normal ratings to insure long life, and as further insurance against tube failure all tubes are twin triode tubes with one-half of each triode section applied to one portion of the circuit, while the other half is connected to another portion of the circuit. As further insurance failure, the grid and anode circuits of all tubes are paralleled. Under the conservative conditions at which the circuits are operated, plus parallel-tube operation, tube life should be many years. Chance of tube failure while in normal operation is small if the tubes are tested occasionally.

Relay Chatter Prevented

To prevent relay chatter and accomplish sharp relay operation, all timers are operated by thyratron tubes. All timer circuits are so designed that the thyratron tubes are normally conducting, and the relays have their coils normally energized. Thus thyratron or coil failure in a relay causes the brakes to be set and the power to be cut off. These extreme precautions against failure were taken because it was realized that the hoistmen would soon accustom themselves to the shrill warning whistle and would unconsciously depend on it to warn them when the cage had passed the shaft collar.

To permit ready checking of the device to make sure that the components were operating properly, a "test" switch associated with the precision timer was installed. When this unit is thrown to "test" position the timing cycle of this timer is made long, allowing the cage to be slowly pulled past the lower and upper coils to test if the brakes will set properly. After the apparatus had been installed, the precision timer was adjusted when hoisting was normal so that the cage would enter the dumping position at just the desired rate of speed without actuating the electronic protective device.

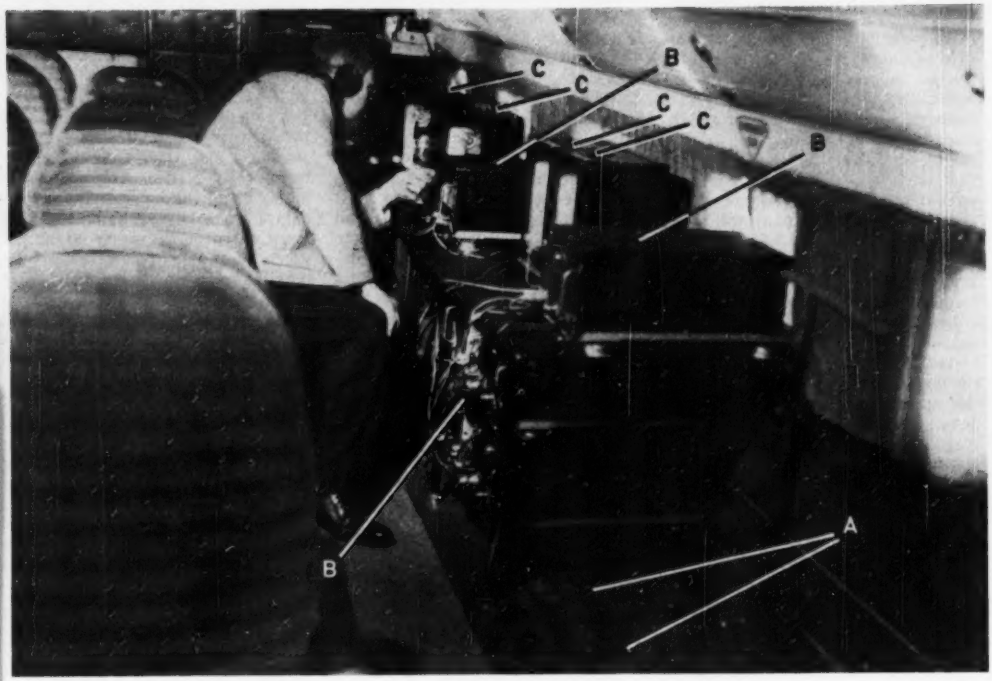
It is interesting to note that on the first day of hoisting by a less experienced hoistman, who had the habit of entering the dump at too high a rate of speed, the apparatus had set the brakes five times during the first hour of hoisting. In the second hour the brakes had been set once, and after that the hoistman experienced no difficulty. It is annoying to the hoistman when the device actuates, and he will quickly learn to enter the dump at a rate of speed that is below the pre-set maximum. Since the difference in time between going past the coils at full speed and at the desired speed is a matter of about 0.4 sec., the device cannot be said to decrease the hoisting capacity of the shaft. As a matter of fact, the reduced mental hazard to the hoistmen who feel secure and the reduced maintenance to the skips and dumping structures result in increased hoisting capacity.

The bridge circuit chosen, the Maxwell bridge, is not the only bridge circuit that may be employed. For example, the Wein bridge circuit could also be used, wherein only a single sensing coil in each of the three positions in the headframe need be installed. In this case, the sensing coil would be installed between the two skip roads.

Device Costs Less Than Conventional Types

The device cost about $850 to construct, including research that went into its development. This represents only a fraction of what a conventional control system would have cost. The apparatus could be readily adapted for use with an eddy-current brake on the hoisting motor. In this case, a uniform deceleration rate from the lower set of coils to the upper set of coils could be accomplished. The third set of coils would not be necessary. When the upper set of coils was passed the post, brakes would be applied, and the circuits could be so arranged that the hoist could be started only in the opposite direction. As a matter of fact, completely automatic hoist operation would be possible at a fraction of the cost of a conventional hoisting system. Automatic operation at the Caselton shaft is not being considered since it is not compatible with existing conditions.

Airborne Radioactivity Surveying



GEIGER COUNTER radiation detectors installed include two banks of small counters, housed in 1-in. lead shields (shown at A), and a bank of large counters (not shown) on left side of cabin. Anti-coincidence counting-rate meters (B) and graphic milliammeters (C) are mounted on table along right side of cabin. Three sets of radiation detectors are operated simultaneously to provide a check on the one master set and additional experimental data.

Radioactive Areas Already Disclosed in Michigan

AN INVESTIGATION by the U. S. Geological Survey hints that Michigan's Northern Peninsula may contain deposits of radioactive materials, Secretary of the Interior Oscar L. Chapman announced on July 26. Airborne Geiger counters have located radioactivity anomalies in the area. The work was done in May and June, 1950, as part of a cooperative program with the Atomic Energy Commission.

The Secretary warned, however, that such radioactivity may be caused by materials, such as thorium, which are of little interest in the present atomic energy program, and do not necessarily indicate the presence of uranium in quantity worth mining.

Details of the flights made in this investigation by the Survey's specially equipped plane are contained in a joint report by F. W. Stead, F. J. Davis, R. A. Nelson, and P. W. Reinhardt. Stead and Nelson are members of the Survey. Davis and Reinhardt are from the Oak Ridge National Laboratory.

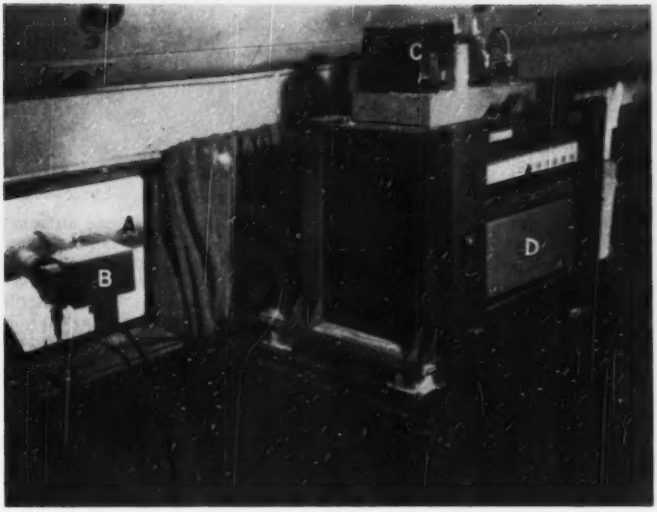
A detailed map showing the approximate location of the anomalies in a 1,600-sq.mi. area accompanies the report.

Copies of the map with explanatory text are available free by addressing a request to the Director of the Geological Survey, Washington 25, D. C.

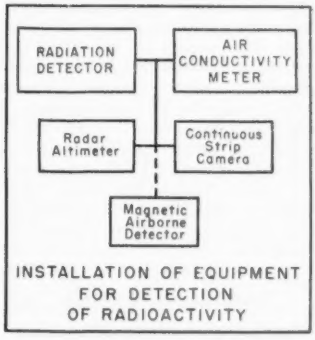
The plane used was the Douglas DC-3A described, with its equipment and the technique employed, in the adjacent article by Mr. Stead in this issue of E&MJ. Flying time required totaled 60 hr., of which 46 hr. was used in actual surveying. All traverses were flown north and south at approximately 500 ft. above the ground at quarter-mile intervals.

Speeds Uranium Prospecting

Existence of anomalies determined in a given area suggests that the probability of radioactive ore occurrences is greater than where anomalies are lacking



AIR-CONDUCTIVITY METER, as installed in plane, is shown. Cylindrical condenser (A), mounted outside of fuselage, is visible through window. Vibrating reed electrometer (B) is mounted directly on condenser. Electrometer output is connected to linear amplifier (C) and Browne graphic recorder (D).



INSTALLATION OF EQUIPMENT FOR DETECTION OF RADIOACTIVITY

CONTINUOUS GRAPHIC RECORDS produced by each instrument, including airborne magnetic detector, are synchronized by edge marks. Intercoupling of equipment permits accurate determination of position of an airborne measurement with respect to ground points. Weight of radiation detection equipment, exclusive of primary power supply, is about 1,400 lb.

FRANK W. STEAD
U. S. Geological Survey
Washington, D. C.

STIMULATED BY THE INCREASED demand for uranium-bearing ores, development of new techniques and instruments that can assist the geologist, the engineer, and the prospector in finding and appraising deposits of those ores has proceeded at a rapid pace. The U. S. Geological Survey, in the comprehensive program it has conducted on behalf of and in cooperation with the U. S. Atomic Energy Commission, has developed a variety of techniques and instruments over the past few years for the detection and measurement of radioactivity. Equipment designed specifically for uranium prospecting falls into three groups dependent on field usage: (1) surface equipment; (2) subsurface equipment, largely radioactivity borehole logging instruments; (3) airborne equipment. This article summarizes the present technique and instrumentation for airborne radioactivity surveying.

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Previous Experience Helps

From the outset, the possibility of developing a means of airborne radioactivity surveying was highly attractive because large areas might be surveyed in a relatively short time at a low unit cost (cost per square mile). Fortunately, the Geological Survey had extensive experience, gained from its development of techniques of aeromagnetic surveying, that would permit determining with accuracy the position of an airborne measurement in respect to the ground.[1] As the method of positioning already was established, full attention could be given to the development of various techniques and instruments for airborne measurements.

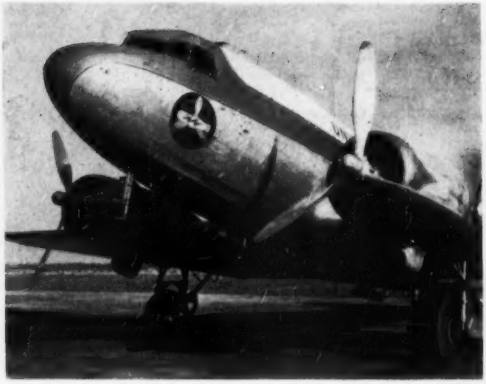
Radioactive elements emit spontaneously radiations known as alpha particles, beta particles, and gamma rays. As alpha and beta particles have exceedingly short ranges in air, the detection of radioactivity by airborne equipment must be directed essentially toward the measurement of gamma radiations. Published data indicate that gamma radiation from ground sources decreases to 50% of the original intensity at about 400 ft. above the ground and to less than 1% of the original intensity at about 2,500 ft. above the ground. It is immediately obvious that, regardless of the intensity of radiation from a ground source, an upper limit of observation exists at about 2,500 ft. above the ground because of the absorption of gamma radiation by air.

Two Techniques

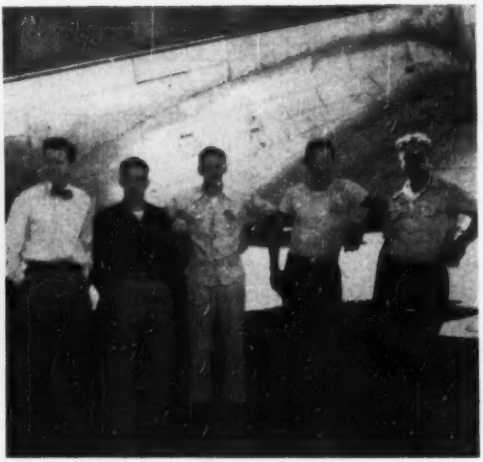
Development of airborne equipment has followed two principal lines of investigation: the first, a technique measuring directly the gamma radiation originating from ground sources; the second, a tech-

[1] Alvin W. Knoerr, "The Airborne Magnetometer: A New Aid to Geophysics," *E&MJ*, Vol. 147, No. 6, pp. 70-75, June, 1946.

Homer Jensen and J. R. Balsley, Jr., "Controlling Plane Position in Aerial Magnetic Surveying," *E&MJ*, Vol. 147, No. 8, pp. 94-95, 153-154, August, 1946.



THE GEOLOGICAL SURVEY'S AIRPLANE, a Douglas DC-3A, was originally modified for aeromagnetic surveying and contained the magnetic airborne detector, a continuous-strip-film Sonne camera, and a recording radio altimeter. Additional equipment for detection of radioactivity has been installed in the plane to take advantage of the technique and instrumentation used for aeromagnetic surveying, particularly the position control for an airborne measurement.



SOME OF THE PERSONNEL comprising the airborne crew. Left to right, J. R. Balsley, Jr., geophysicist, W. B. White, co-pilot, and F. W. Stead, geologist, U. S. Geological Survey; and P. W. Reinhardt, physicist, and F. J. Davis, physicist, Oak Ridge National Laboratory, U. S. A.E.C.

nique of measuring the ionization of the atmosphere caused by cosmic radiation and gamma radiation from both ground and airborne sources.

The first technique was restricted almost from the outset to the Geiger counter as the radiation detector, and the equipment now consists of a hexagonal bundle of 19 Geiger counters connected to an anti-coincidence counting-rate meter. Each Geiger counter is 2 in. in diameter and 42 in. in over-all length and has an effective sensitive area of 80 sq. in. (2 by 40 in.); the bundle of 19 counters is 10 in. in diameter by 44 in. in over-all length and has an effective sensitive area of approximately 1,500 sq. in.

Sensitivity Increased

By the use of an anti-coincidence circuit, which eliminates multiple or coincidence pulses originating from hard cosmic radiation striking the bundle of counters, the sensitivity of measurement is much increased; that is, the fluctuating background counting rate due to hard cosmic radiation is in large part eliminated, thereby permitting a smaller increase due to the softer gamma radiation from ground sources to be identified with certainty. The sensitivity of the present equipment is such that, at 500 ft. above the ground, a change of about 0.001% uranium in the rocks and soils of the area can be detected.

The second technique, still in the experimental stage, utilizes an air conductivity chamber which consists essentially of a cylindrical condenser with the inner coaxial member connected to a vibrating reed electrometer. When air is passed through the cylinder, the ions are collected on the members of the cylindrical condenser under the influence of an electrical field between the members. The ionization current can be made independent of the rate of flow by operating at a collection voltage below saturation; that is, only a portion of the ions passing through the cylinder are collected. More than 50% of the total ionization of the atmosphere at 500 ft. above the ground may be caused by radon and its disintegration products which have escaped from ground sources; however, the many interrelated factors controlling the amount of radon in the atmosphere at any given time and place have prevented the establishment of a satisfactory interpretation of the data acquired with the air conductivity meter. This technique, therefore, is not currently used to define radioactivity anomalies and is employed solely to confirm measurements made with the Geiger counter radiation detector.

The Geiger counter radiation detectors and the air conductivity meter are installed in a Douglas DC-3A airplane. The installation of instruments for detection of radioactivity was so planned as to utilize equipment previously installed in the airplane for aeromagnetic surveying; namely, a continuous-strip camera and a recording radar altimeter. As all equipment in the plane records continuously on graphic milliammeters, the data are synchronized by edge marks which are automatically printed on each chart.

In conducting an airborne radioactivity survey, all measurements are made at approximately 500 ft. above the ground. Flight paths or traverses are spaced at quarter-mile intervals. Aerial photographs are normally used for pilot guidance, and the flight path is recorded by the gyrostabilized, continuous-strip-film camera. The distance that the survey plane flies above the ground is readily measured with a continuously recording radar altimeter.

Defining an Anomaly

Owing to the random nature of radioactivity, a radioactivity anomaly must be defined primarily on a statistical basis. For the Geiger counter radiation detector, the standard deviation of a measurement due to statistical fluctuation is about 10% of the average background counting rate; therefore, a measurement must exceed the average background by 20% or more before it

can be considered as an anomaly indicative of a local area of greater-than-average radioactivity. An anomaly is further defined by the rate of rise and fall of the observed radiation intensity. Where the time constant or response period of the detector is one second and the flying speed is about 200 ft. per second, the rise and fall of radiation intensity must occur within about 8 seconds. Should this change in radiation intensity maintain itself over a longer time period, such a change reflects, not a local concentration of radioactive materials, but a systematic variation in the radioactive content of the rocks and soils of that particular area.

Area Coverage Adequate

At 500 ft. above the ground, the width of the zone from which the radioactivity is measured is at least 1,400 ft. If the flight paths of the airplane are spaced at quarter-mile or 1,320-ft. intervals, it follows that the entire area should be covered adequately by an air-borne radioactivity survey. However, as a radioactivity anomaly is defined fundamentally on a statistical basis, the possibility exists that a small area of considerable radioactivity might not be noted where that small area is midway between flight paths and far distant from the radiation detector.

Plotting the Anomalies

The location of an airborne radioactivity anomaly in respect to the ground can be determined with a high degree of accuracy from the continuous-strip photograph provided by the gyrostabilized camera; however, the precise plotting of anomalies is controlled by the accuracy of the available base maps and the presence of recognizable landmarks. In a very recent survey,[2] the true position of the anomalies as shown on the map might be in error by as much as a quarter of a mile. Such error was caused for the most part by the local errors up to a quarter of a mile in the available base maps and by blank areas up to 25 sq. mi. in which it was impossible to find and plot recognizable landmarks. The compilation and plotting of data require the assumption of straight-line flight and constant ground speed between recognizable positions on the base maps; thus, if the distance between such points is large, the error in the estimated position midway between the points may be considerable.

[2]F. W. Stead, F. J. Davis, R. A. Nelson, P. W. Reinhardt, "Airborne Radioactivity Survey of Parts of Marquette, Dickinson, and Baraga Counties, Michigan," U. S. Geological Survey, July, 1950. A limited number of copies of the map and explanatory text may be obtained free of charge from the U. S. Geological Survey, Washington 25, D. C.

What the Anomaly Detected Represents

Radioactivity anomalies detected by airborne measurements cannot be interpreted at present in terms of either the radioactive content or the actual size of the locality causing the anomaly. The present technique of airborne measurement does not distinguish between the activity due to thorium and that due to uranium. An anomaly, therefore, may represent radioactivity due entirely to uranium, or to thorium, or to a combination of uranium and thorium.

A radioactivity anomaly, recorded by airborne measurement at 500 ft. above the ground, can be caused by three things, which are listed as follows:

1. A moderately large area in which the rocks and soils are slightly more radioactive than are the normal rocks and soils of the whole area surveyed.
2. A small area in which the rocks and soils are considerably more radioacitve than are the normal rocks and soils in the whole area surveyed.
3. A very small area in which the rocks and soils are highly radioactive and considerably exceed the radioactivity of the normal rocks and soils in the surrounding areas.

Any particular anomaly, therefore, may represent either slightly greater-than-average activity over a distance of about 1,000 ft., or high radioactivity over a distance of a few tens of feet. An anomaly can be interpreted to mean only that the locality represented is more radioactive than the surrounding area.

The Optimum Flight Level

Certain limitations on the applicability of airborne radioactivity surveying exist primarily because the absorption of gamma radiation by air limits the distance above ground at which significant measurements can be made. Based on theoretical, empirical, and practical considerations, the optimum level for surveying is about 500 ft. above the ground. In areas of high relief, it is not possible to maintain a 500-ft. flight level with a large airplane, such as a Douglas DC-3, and marked variations in flight level from a few hundreds of feet to over a thousand feet make the interpretation of the radioactivity measurements made during the flight of the plane exceedingly complex if not impossible.

Recent development, including the adaptation of a large scintillation counter to airborne measurement, suggests that it will be possible in the near future to correct airborne measurements of radioactivity for variation in distance above the ground. This would permit extending airborne radioactivity surveying to areas of greater relief than has heretofore been possible. The use of a helicopter with its greater flexibility would overcome in large part the difficulties of marked topographic relief, but this would involve a considerable sacrifice in the over-all speed of surveying. Using a Douglas DC-3 airplane, it is possible to survey approximately 30 square miles in one hour.

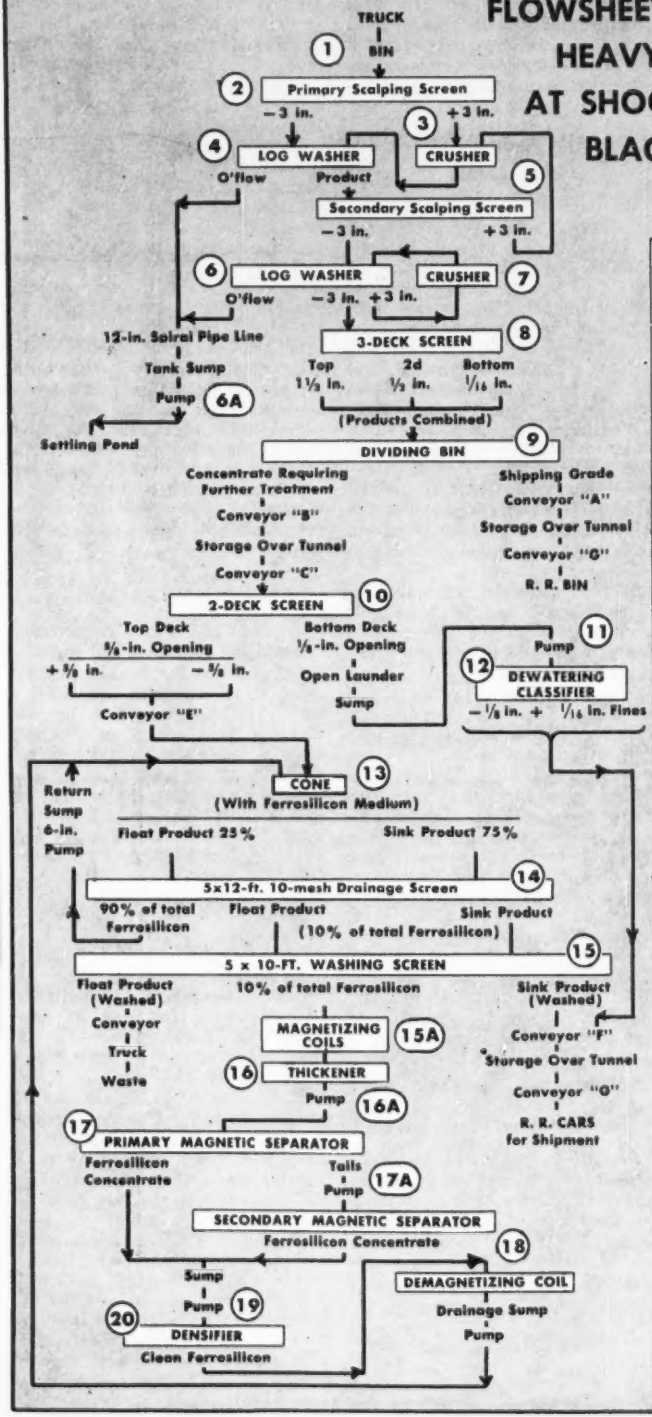
Possible Light on Geology

Analysis of the data from recent surveys has suggested the possibility of rapid reconnaissance geologic mapping by airborne radioactivity surveying. Assuming that the rock and soil units in a given area will show a systematic variation in radioactive content, it should be possible to delineate zones of varying radioactivity that could be correlated with particular rock and soil units by limited ground examination.

Airborne Survey Quick, Unit Cost Low

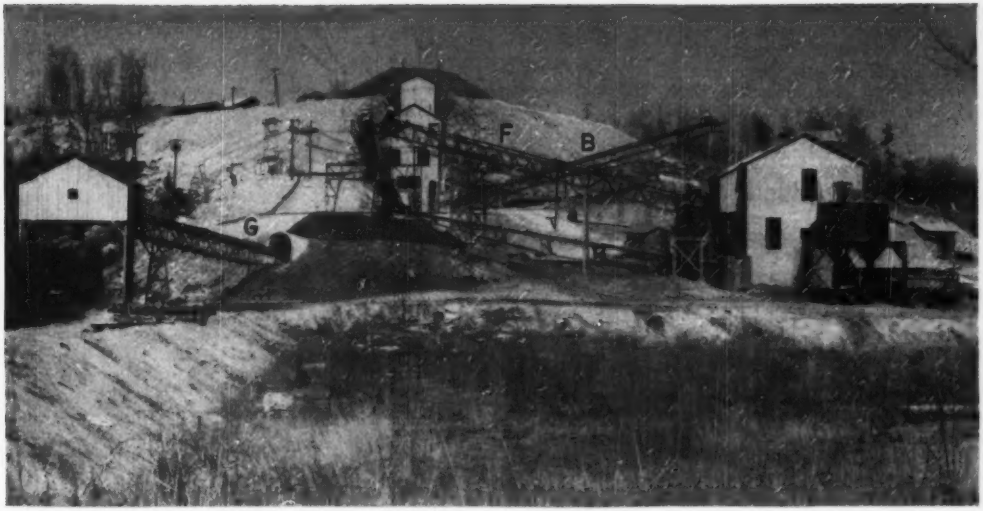
In summary, airborne radioactivity surveying offers the possibility of prospecting for uranium over large areas in a short time at a low unit cost. Although airborne radioactivity anomalies cannot be interpreted in terms of actual size of radioactive content of the particular locality, the existence of anomalies in a given area suggests a greater probability of occurrence of uranium and thorium deposits than would a total lack of anomalies in an area. Further development of the technique will be continued, and it is anticipated that the sensitivity of measurement and the interpretation of data can be improved to permit a better definition of anomalies and the extension of the technique to areas of greater topographic relief.

FLOWSHEET OF WASHER AND HEAVY-MEDIA PLANT AT SHOOK & FLETCHER'S BLACKBURN MINE



LEGEND

1. Steel-lined concrete muck bin
2. Simplicity Shake-Out heavy-duty vibrating screen. Single-deck, 3x3-in. square hole
3. McLanahan Stone 24x36-in. Rock-master single-roll crusher, set to 3-in.
4. McLanahan Stone double log washer. Two 8-in. by 25-ft. logs.
5. Simplicity 4x10-ft. scalping screen, 3-in. opening.
6. McLanahan Stone double log washer. Two 8-in.x30-ft. logs.
6A. Allis-Chalmers 8x10-in. solids-handling pump. 100-hp. motor
7. McLanahan Stone single-roll crusher, 18-in.x24-in.
8. Ripl-Flo 4x10-ft. triple deck screen
9. Dividing bin. From this, combined product can go to one of two conveyors
10. Allis-Chalmers 5x16-ft. low-head double-deck screen
11. Allis-Chalmers 4x3-in. solids-handling centrifugal pump
12. Wemco SH classifier, 36-in. in diameter x 19-ft. 3-in. long inside
13. Cone, 10-ft. diameter at top, with 9-in. internal airlift. Part of Wemco No. 4 Mobil-Mill. Cone mechanism driven by 5-hp. motor
14. Allis-Chalmers single-deck 5x12-ft. low-head screen for drainage, 10 mesh.
15. Allis-Chalmers single-deck 5x10-ft. low-head screen for washing, 10 mesh.
15A. Magnetizing blocks
16. Thickener
16A. Low-head Wemco pump, 2-in. (thickener underflow pump).
17. Primary Crockett magnetic separator, 36-in.
17A. Wemco low-head pump, 3-in.
18. Secondary magnetic separator, 36-in.
19. Wemco pump, 2-in.
20. Densifier



FLEXIBILITY OF OPERATION has been obtained in designing Shook & Fletcher's Blackburn beneficiation plant. Storage for 15,000 tons is provided outdoors between washer (center) and heavy-density plant (right). Latter conceals storage pile and reclaiming conveyor C behind the building. Entire output of plant on night shift is stockpiled over reclaiming conveyor G and tunnel (center) for loading into railroad cars on day shift.

Blackburn Heavy-Density Plant Opens New Brown Iron Ore Reserves

ALFRED M. SHOOK
Shook & Fletcher Supply Co.
Birmingham, Ala.

HEAVY-DENSITY separation is providing a solution to the economic problem involved in mining the brown iron ore found in Franklin County and processed at the Blackburn mine, near Russellville, Ala., about 120 miles northwest of Birmingham. A ferruginous chert and gravel overlying the ore at this open-pit property and running through it in streaks, even after it has been stripped, has made beneficiation difficult in the past. Ninety percent of the ore in this deposit is thus contaminated. Jigs have been tried but could not handle the necessary tonnage. Hand-picking the coarse sizes while jigging the fine sizes became prohibitive when rising wages forced the elimination of hand picking. The amount of iron in the gravel was too great to throw away if the operation was to pay. The scheme adopted by Shook & Fletcher Supply Co., of Birmingham, owner and operator, involves screening at 3 in. with crushing of the oversize, followed by log washers and screens to remove the slimes and separate the bulk of the gravel as minus-⅛-in. plus-1/16-in. fines from the plus ⅝-in. and minus ⅝-in. plus ⅛-in. sizes. The latter sizes are combined and put through a heavy-density cone. The fines are blended with the sink product of the cone for shipment, thus saving the iron in them although lowering the shipping grade from 50 to 47% Fe, dry analysis. The problem is still being studied in hope of betterment. The product shipped runs about 18% insoluble. The beneficiation procedure is outlined in the flowsheet which is shown on the opposite page.

Use of these ores in Alabama charcoal furnaces antedates that of the red ores. Furnace men considered them highly advantageous for mixing with the latter. When beneficiated, the ores still find a ready market in the district. Current production of brown iron ore is ap-

Analysis of Three Samples Representing Different Shipments From Blackburn Mine—Dry Basis

	1	2	3
Iron, %	48.69	50.40	46.07
Insoluble, %	18.70	13.92	20.11
Phosphorus, %	0.52	0.60	0.56
Manganese, %	0.92	0.85	1.11
Moisture, %	5.86	4.58	4.73

Data on Conveyors in Ore-Handling System, Blackburn Mine

All belts 24 in. wide. Belt Speed 200 fpm.

Belt Conveyor	Tons Per Hour	Center Distance	Lift	Drive hp.
A	150	177 ft. 1 in.	19 ft. 9 in.	10
B	150	131 ft. 9 in.	35 ft. 0 in.	15
C	150	67 ft. 3 in.	13 ft. 7 in.	7½
E	175	60 ft. 8 in.	12 ft. 9 in.	7½
F	175	135 ft. 0 in.	34 ft. 6 in.	20
G	300	122 ft. 4 in.	17 ft. 3 in.	15

proximately one million tons annually.

Advantages claimed for the use of these ores are: (1) They have a lower melting point than the Birmingham red ores and take less coke in the furnace. (2) They contain more units of iron than the red ore and increase the blast-furnace yield.

Where the Ores Occur

The Alabama brown iron ores are known to occur in three general areas—in Franklin County, as already mentioned, in Tuscaloosa and Bibb Counties, southwest of Birmingham, and in several counties of eastern Alabama, the occurrences there extending over into Georgia. Of these areas Russellville is the most promising today with the advent of heavy-density separation.

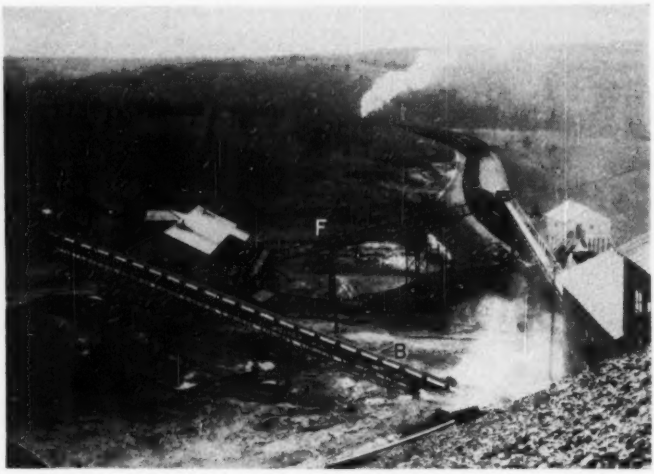
Lack of uniformity characterizes the occurrences. The deposits are residual and are found under varying depths of overburden. Nowhere are they continuous. The iron occurs in general as limonite and related minerals having combined moisture and is found in fragments, or pieces, in a matrix of sand and gravel, the sizes ranging from large "dornicks," or masses, down to minus ⅛-in.

The deposits are always on top of the flat-lying Bangor limestone. They are later than the limestone, which is Mississippian in age, being regarded as Lower Cretaceous. In places the limestone outcrops. Occurrence of some iron as carbonate suggests that this may have been the original form.

Shook & Fletcher have maintained an interest over many years in the exploitation of the brown ores. At present they have three other brown ore mines besides the Blackburn mine in operation. These are: the Warner mine 5 miles southwest of Russellville; the Adkins mine 30 miles south of Birmingham; and the Tait's Gap mine 35 miles north of the city. They have four prospecting drills in the field.

Extending Known Reserves

The known reserves of brown ore are limited. The means used for extending this knowledge are therefore important. Exploration for brown ore today is done with 6-in. churn drills. Other types of drills have proved unsatisfactory. The practice of digging test pits employed before the shallower deposits were worked out no longer suffices. The present practice is similar to Mesabi practice, save that the holes are spaced more closely, say at 100 ft. centers, with check holes, if necessary, in between.



A RAILROAD SPUR 2 miles long built by Shook & Fletcher connects Blackburn mine with spur of Southern Railway. Conveyor A, from washer (right) and conveyor F from heavy-density plant (left) deliver to storage pile for loading cars. Conveyor B delivers to storage ahead of heavy-density plant.

At the Blackburn mine, where Shook & Fletcher have a large acreage, drilling was under way for two years before construction was undertaken. Depth of overburden varies from 0 to 75 ft. The average thickness of the ore is 15 ft.

Draglines for Mining

Mining at the Blackburn is done with draglines and transportation with trucks. Draglines are preferred because the trucks can be kept out of the pit on dry ground at all times. Three machines are employed, each of which does its own stripping as well.

Operation at this property is difficult, compared with that at some other mines, because of the varying position of the ore, which is now flat, now pitching or rolling.

The excavators comprise one diesel-driven walker-type dragline of Bucyrus-Monighan make (Type 3W) having a 100-ft. boom and a 2½ or 3-cu.yd. heavy-duty bucket; also two Model 802 Lima machines with 50 to 80-ft. booms and 2 to 3-cu.yd. Hendrix buckets, the bucket size depending on the boom length. The basic boom for the latter draglines has two 25-ft. sections. The 50-ft. boom thus obtained can be lengthened to 60, 70 or 80 ft., according to the digging depth, by inserting either one or both of two extension sections, respectively 10 and 20 ft. long, provided for each of the two machines.

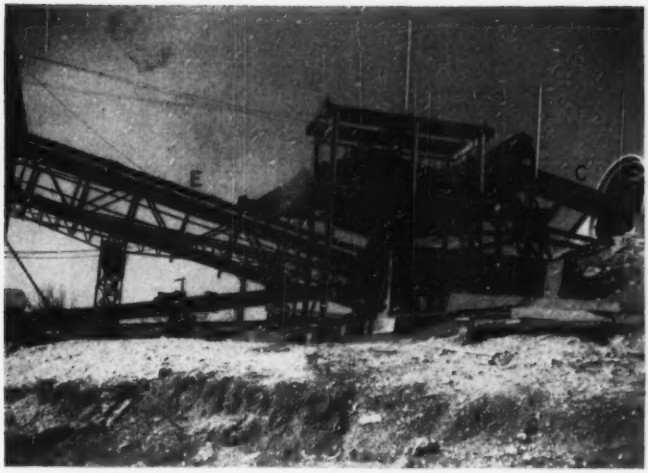
Hauling is done with 15-ton rear-dump Euclid trucks, equipped with 150-hp. Cummins engines. An effort is made to hold the size of pieces loaded to 42 in. Some shooting is necessary. The distance hauled to the plant, one way, is half a mile at present. Roads are kept in excellent condition. They are surfaced with waste gravel from the heavy-density plant and are patrolled daily by a Caterpillar 12 Road Patrol. A water truck is provided to keep the dust down. Several bulldozers also are in use for miscellaneous tasks at mine and plant.

Approximately 3,000 cu.yd. of material is handled per day by the draglines, including stripping and ore. About 3 cu.yd. of stripping is required per cu. yd. of muck.

Rated Plant Capacity 125 tph. in Good Material

At the plant a large amount of muck is stockpiled for rainy days as well as for the night shift. A 1½-cu.yd. shovel and two trucks serve the plant at such times. Approximately 3 cu.yd. of muck is required to make 1 ton of concentrate for shipment.

The Heavy-Media plant installed is a No. 4 Mobil-Mill built by Western Machinery Co. Certain additions and modifications have been



RECLAIMING CONVEYOR C delivers washed ore from the storage pile to 5x16-ft. screen ahead of heavy-density plant (out of picture to left). Screen discharges to conveyor E. At extreme right may be seen end pre-formed section of reinforced-concrete reclaiming tunnel housing conveyor C.

made by Shook & Fletcher. Instead of two 24-in. Crockett wet-magnetic separators, normally provided as standard for the No. 4 mill, two 36-in. Crockett machines are used.

The plant was started Jan. 1 this year and in the first four months shipped approximately 100,000 tons. It has been running two shifts six days per week. The No. 4 Mobil-Mill's capacity is rated at 125 tons per hour. Actual capacity is not yet known by reason of the changes made and the variation in the amount of fines and size of ore. The minus ⅛-in. plus 1/16-in. fines are blended with the sink product of the cone in an approximate ratio of 1 ton to every 5 tons of concentrate.

Supplementing the Flowsheet

Treatment of the ore is explained in the flowsheet. The following facts are added. Water at 100 psi. is used for sluicing at the muck bin (1 in the flowsheet). The crude muck may be in lumps. The plant will handle anything that will go through the 1½-cu.yd. dipper of the shovel at the plant.

Scalping screen (5) repeats the screening at 3 in. to remove possible slabs.

At the dividing bin (9) the ore may go to either one of the two conveyors A and B. If free of rock, it will go direct to the loading tunnel via conveyor A. If it requires treatment, it will go to the screen ahead of the heavy-density plant for removal of minus ⅛-in. material from the cone feed. The head pulley of conveyor C which delivers to this screen is a Stearns magnetic pulley for removing tramp iron. This screen (10) has two decks to get better screening.

Data pertaining to conveyors A to G inclusive are given in the accompanying table. All the conveyors were furnished by Continental Gin Co., Birmingham.

Operating the Cone

In the cone (13) an effort is made to maintain a gravity of 2.90 at the bottom and 2.80 at the top. Ferrosilicon of mesh 65x down is used as medium. It is of 85-15 grade (85% iron and 15% silicon). Consumption has been about 1 lb. per ton of feed.

No rinse water is applied on the first 9 ft. of drainage screen (14), following the cone. The undersize from this 9-ft. stretch, comprising about 90% of the total ferrosilicon which is in the cone overflow, is returned direct to the cone, without cleaning, via a sump and a 6-in. medium-return pump.

Slime in the circuit affects the gravity and the separation. If there is an excessive amount, it makes the cone viscous and it is necessary to stop and clean the medium. The worst that can happen is a plug-up in the air lift. A vertical 1¼-in. ram rod running up through the air lift is used to clean out such plug-ups when they occur.

When the cone is running well, with clean feed and minimum fines, there will be a little water on top of the float material in the cone. When the float material puffs up and rises up above the surface, the cone is beginning to get viscous. A differential of at least 0.10 in the gravity is needed between top and bottom.

About 200 gpm. of fresh water is added to the cleaning circuit at washing screen (15) and at the Crocket magnetic separators (17) and (18).

Water Supply Ample

The supply of water for the plant is obtained from nearby Cedar Creek. It is raised from the stream by a 2,000-gpm. Deming turbine pump located in a small building on a foot bridge that spans the creek. This is driven by a 100-hp. motor. The total head is 173 ft., including the static friction.

When a shut-down occurs, unless the cone is dumped, air is kept on to agitate and circulate the medium. Approximately 20-30 min. is required to shut down. The same amount of time is consumed in getting the cone working properly after starting up.

Storage capacity for about 15,000 tons is provided between the washer and the heavy-density plant. The latter may thus keep running for some time even though the washer shuts down.

The ferruginous chert gravel which is blended with the cone concentrate for shipment is angular but not sharply so. It contains considerable alumina. A chert usually carries 5 or 6%.

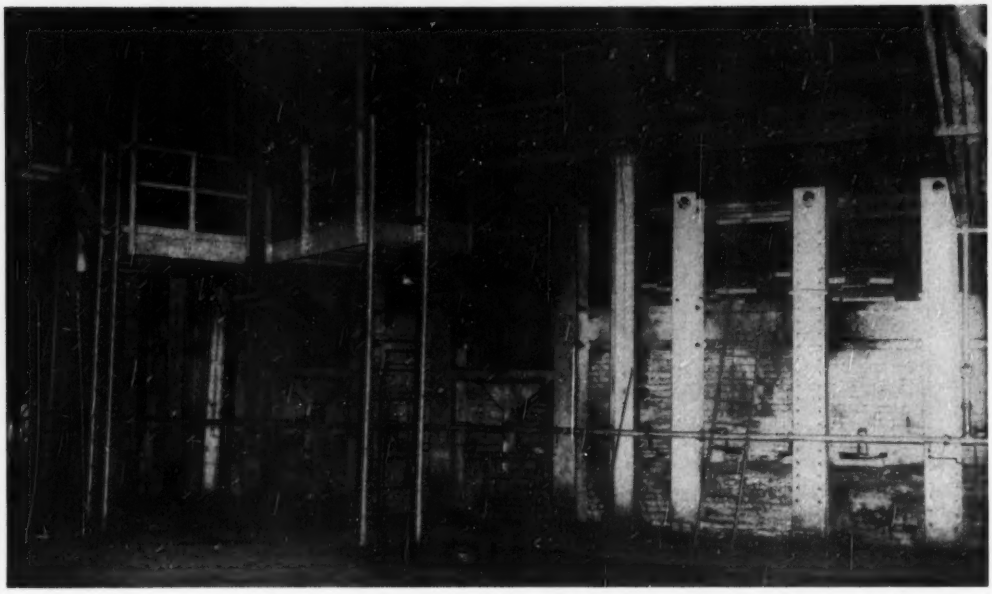
The Labor Force

About 58 men are required for operating the mine and plant for two shifts. Loading is done on day shift only.

The operation is flexible. The mill output on the night shift is stocked over the reclaiming tunnel to be loaded into railroad cars on day shift. The storage capacity at this point is about 5,000 tons of finished product.

Interesting construction marks the two reclaiming tunnels. They are assembled from pre-formed sections of railroad culvert made of reinforced concrete. These are made by the Massey Concrete Products Co., Birmingham.

E. H. Craddock is superintendent for Shook & Fletcher Supply. Co. at Russellville.



TWO WAGSTAFF GUN FEEDERS on the north side of the Hayden reverberatory, seen here, and one on the south side supply calcines to the furnace. Both gas and air are entirely cut off by manual controls when charging.

Hayden Reports on a Long Campaign

When the reverb at AS&R's Hayden plant ended a 6½-year campaign, the smelter management found out that careful maintenance, close fire and temperature control and a leisurely smelting rate had paid off in well preserved walls and arches.

F. J. DOWNEY
Plant Superintendent
American Smelting & Refining Co.
Hayden, Arizona

ON SEPTEMBER 7, 1942, the Hayden reverberatory furnace began a campaign which lasted through the war years, the "peace" and almost into another war, for it was continuously under fire until April 18, 1949, when it was shut down for crucible and tap-hole repair. During the campaign, a total of 851,758 solid tons was smelted with the furnace smelting only 70% of the time and then only at 50% capacity. Operating fuel consumption averaged 3,529 million Btu. per ton.

The furnace which handles all the concentrates from Kennecott Copper Corp.'s Hayden mill and some custom business is of conventional design. Silica brick is used in the side walls and sprung arch, and chemically bonded magnesite brick in the crucible. The original crucible bottom was put in by fusing crushed magnetite at 3,100 deg. F. Arch on the uptake from the furnace to the waste heat boilers is suspended fire brick with silica brick in the walls.

Inside dimensions are 104x22 ft. Height between the original furnace bottom and the arch is 10 ft. 4 in. at the firing end, and 9 ft. 8 in. at the flue end.

Natural gas, averaging 1,100 Btu. per cu. ft., is used in smelting, with forced draft supplying the necessary air for combustion. Air-gas ratio is 10:1. Seven 25x16x6-in. cast iron multiple type burner blocks each have 38 burner jets, 9/64-in. inlet diameter. Air is supplied by a motor-driven fan at 8-oz. pressure, and natural gas varies from 5 to 15-psi. pressure, depending on the tonnage to be smelted. Copper water jackets are installed below the burners and cast iron water jackets above. Converter slag launder enters the furnace on the burner and near the south wall.

During shutdown periods, when no charge is smelted, 20,000 cu. ft. of gas is burned per hour to keep the furnace hot. This is accomplished by using two conventional block burners on the regular firing end and two Denver Fire Clay Inspiration burners, one on each side, 70 ft. from the back end.

Use Gun Feeders

Three Wagstaff gun feeders,* 12 in. in diameter, supply calcines to the furnace. Two are on the north side and one on the south side, set on a 60-deg. angle with the long

*U. S. Patent Nos. 1,822,865 and 2,037,554.

dimension of the furnace, and on a slope of 7½ in. to 12 in.

Usually the two feed guns on the north side are used for charging at the same time, two cars of calcines, 6 tons each, being dropped in 30 to 45 sec. Both gas and air are entirely cut off by manual controls when charging.

Two matte tap-holes on each side are approximately 20 ft. from the firing end, and the slag skim bay is located on the side near the front. An average of 14 in. of slag and 28 in. of matte are carried in the furnace crucible. Matte temperature is 2,000 deg. F., and slag temperature 2,150 deg. F. Each skim takes off 55 tons of slag which assays Cu, .36%; SiO_2, 38.5%; FeO, 41.3%; CaO, 8.6%; Al_2O_3, 6.8%.

The matte contains 41.5% copper.

Draft within the furnace is held at .04 in. W. G. by means of an Askania unit regulating the dampers on the exit flues from the two 800-hp. Keeler waste heat boilers. A Bristol gage records draft variations. Regular surveys are made on gases within the furnace to check on fuel combustion. An average gas analysis shows 11.7% CO_2 and SO_2; 0.4% O_2; and virtually no CO.

When necessary, either waste heat boiler can be shut off from the furnace by dropping a water cooled damper, the tubes of which are protected by a refractory mix of fine ground fire brick and cement. These dampers are raised and lowered by electric hoists.

Slurry Preserves Arch

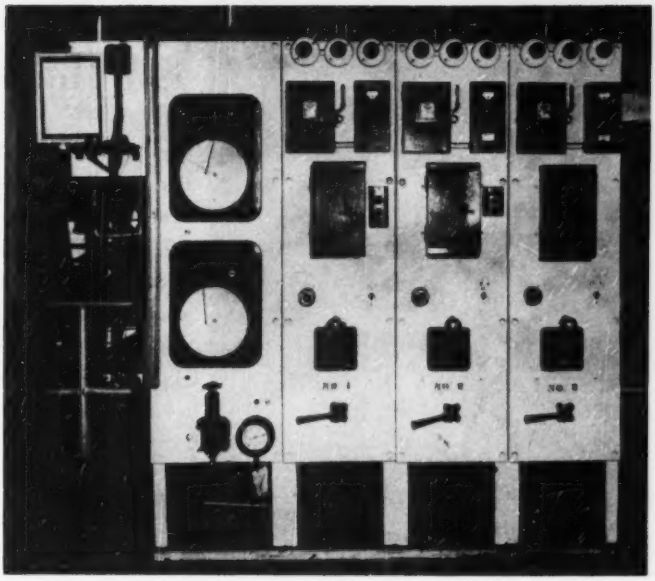
Silica slurry is used to prolong the life of both the arch and side walls in the smelting zone. It is applied along the lines of the process of the Winkler et al. patent No. 2,124,865 of Phelps Dodge Corp. No slurry is sprayed on the brick work in the settling zone. Slurry is sprayed on only when needed and only on day shift.

Slurry mix for the arch consists of 200 lb. of fine ground silica, 2 lb. Bentonite and 50 gal. water. Mix for the side walls contains 300 lb. silica, 1 lb. Bentonite and 50 gal. water.

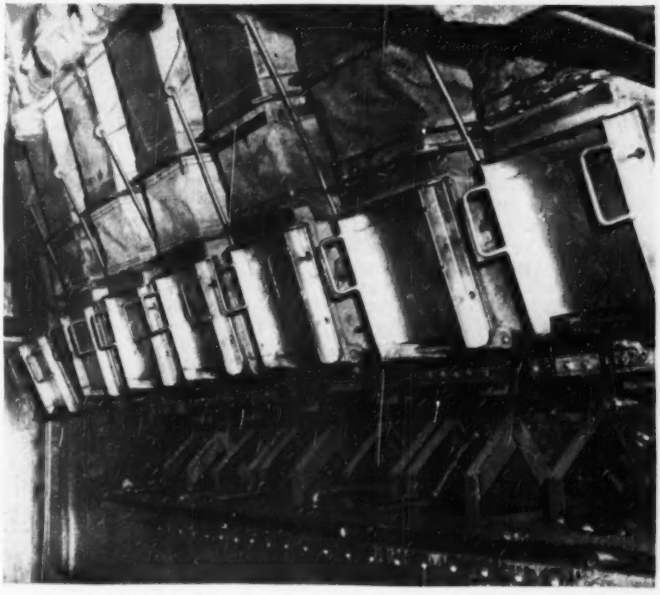
After 6½ years under fire, the original 20-in. silica arch measured 19 in. plus ¾ in. slurry. Original brick in the front section measured 19½ in. and had never been slurried. Hayden engineers attribute the long life of this arch to:

1. Proper use of silica.
2. Low tonnage smelted per day.
3. Good fire and temperature control.
4. Lack of impurities in the charge.

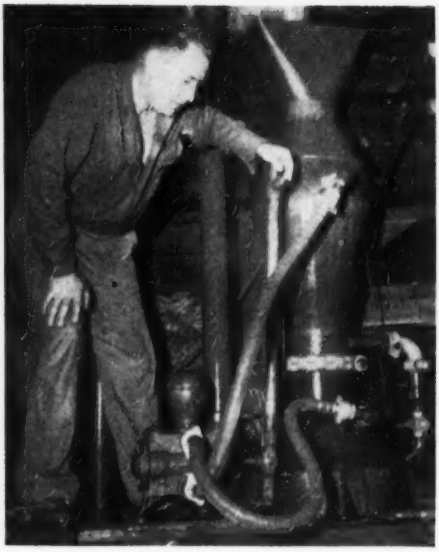
New installations planned for the Hayden smelter include a 30,000-cfm. turbo blower to supply converter air requirements, a 4,000-kw. turbogenerator and a 13x30-ft. Pierce-Smith converter. At the same time the waste heat boilers are being converted from low pressure (180 psi.) to high pressure (420 psi.).



CONTROL BOARD for Wagstaff feed guns.



FORCED DRAFT BURNERS showing two water jackets on the bottom.



Hydraulic Material Lift For Hoisting Crushed Ore

Percy S. Gardner, Jr.,[1] mine engineer and inventor, demonstrates a working model which "hoists" crushed ore through a 4-in. discharge line of a 40-ft. balanced lift. The charging chamber shown here introduces the ore into a circulating water system. One step in the charging cycle involves operation of the displacement pump shown at left. Hand-operated parts of this experimental model would be replaced by motor-operated parts in the proposed mine installations on page 85.

[1]Formerly superintendent, Silver Dollar Mining Co., Wallace, Idaho, now with Bagdad Mining Co., Philipsburg, Montana.

THE PRINCIPLE OF PUMPING ORE vertically out of mines instead of hoisting it appears to be one step closer to reality, now that Percy S. Gardner, Jr., has demonstrated its feasibility with working models. He has been experimenting with this method for more than 10 years and has been sufficiently successful in his work to apply for a patent on the method.

When E&MJ staff members visited the Silver Dollar property last November, Mr. Gardner demonstrated the model shown above which was installed in an abandoned mill building on the property. The installation consisted of two parallel vertical 40-ft. 4-in. pipes connected at the bottom to produce a balanced head arrangement. A centrifugal pump at the top of this installation pumped water through these pipe columns. The special charging chamber with valves and displacement pump shown above was used to introduce batches of crushed ore into the bottom of this closed hydraulic circuit. Just to show the full possibilities of the equipment, Mr. Gardner threw a handful of rock bits and some grinding balls into the hopper, and these items together with the ore were "hoisted" to the top of the discharge line in a matter of seconds after the proper valves had been adjusted.

Both the experimental unit shown above and the proposed mine installation shown on page 85 operate as follows:

1. Crushed ore is fed into the hopper on top of the unit.
2. Ore is then dropped into the upper chamber through a charging valve.
3. Upper charging valve is closed.
4. Pressure inside of the upper chamber is equalized with that in the lower chamber by means of a solenoid pressure equalizer.
5. Lower charging valve is opened to allow the ore to settle into the lower chamber.
6. The lower charging valve is closed.
7. Displacement pump operates, thus lowering the water level in the upper chamber. Crushed ore is elevated to the surface in the discharge column.

Note: In the proposed mine installation charging valves and displacement pump will be motor-operated, whereas in the experimental model shown above these parts were hand-operated.

Tests with the working model indicate that the unit can handle 20 lb. of rock per cu. ft. of water circulated. On this basis, Mr. Gardner estimates that a mine installation could handle about 960 tons of crushed ore per 8-hr. shift through a 10-in. pipe. This calculation is based on the assumption that ore would be charged in 1-ton batches according to the following cycle:

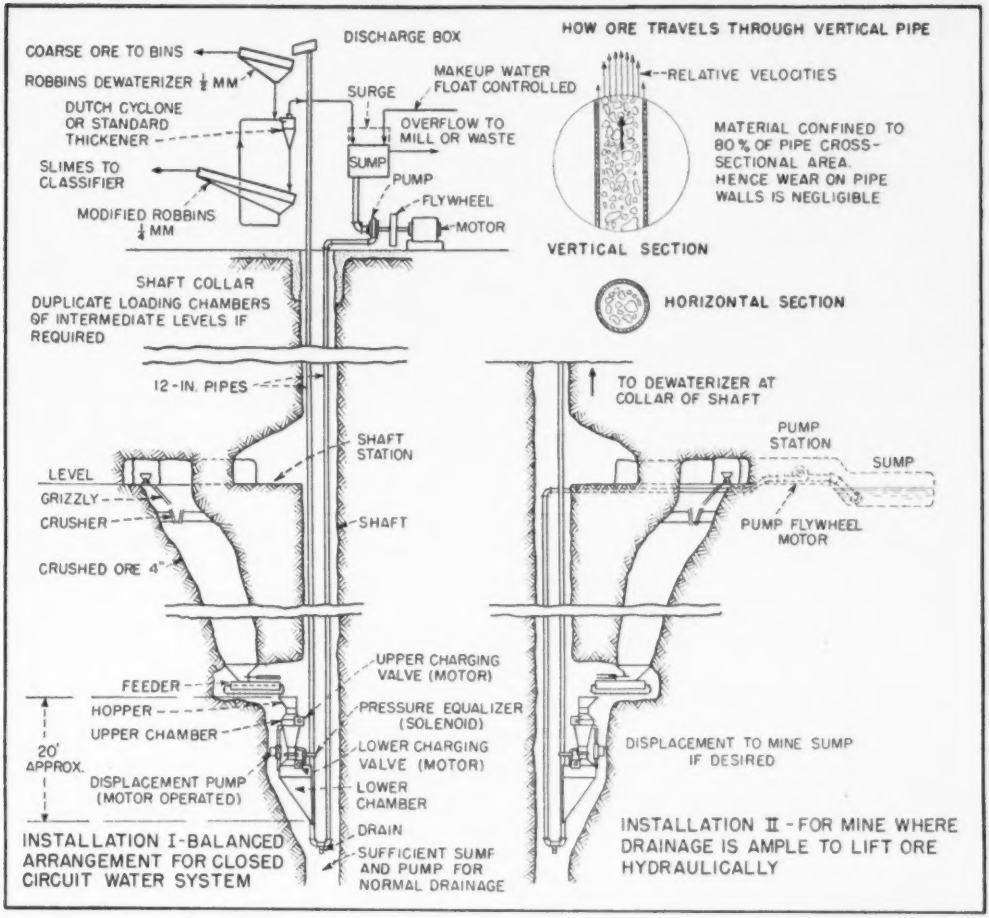
1. Upper charging valve opens. Charge drops into upper chamber	3 sec.
2. Upper charging valve closes. Feeder fills hopper during rest of cycle	1 sec.
3. Pressure equalizer operates	1 sec.
4. Lower charging valve opens, ore drops	5 sec.
5. Lower charging valve closes	1 sec.
6. Displacement pump operates	19 sec.
Full cycle—while charge feeds from lower chamber to column	30 sec.

Also on the basis of experimental data, Mr. Gardner estimates that a mine installation would require approximately 165 hp. to lift ore at the rate of 960 tons per 8 hr. (1 ton per 30 sec.) through 10-in. pipe in a 1,000-ft. balanced lift system. This calculation assumes that 1 cu. ft. of water would be sufficient to raise 20 lb. of ore. Under these conditions, the system would have to circulate about 1,500 gpm.

If a mine pumps out sufficient water to handle the ore which it produces, it would be possible to modify the installation by eliminating the balanced lift and introducing the ore directly into the pump discharge line as shown in Installation II, page 85.

Ore pumped to the top of the column in either installation could be dewatered with the equipment indicated. Pumps shown in the proposed installations are equipped with flywheels which would furnish energy to clear out the line in event of a power failure.

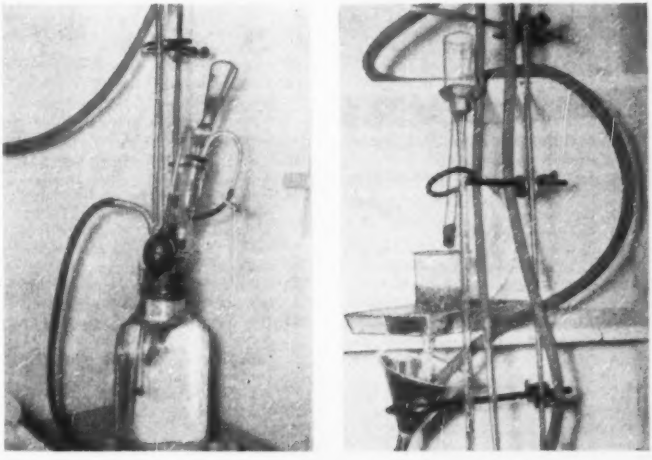
The experimental transparent model shown at right was used to observe the movement of ore particles through the system. A variable constant-head was used instead of a pump to circulate water through the circuit. Elevation of the constant head above the discharge point of the ore indicated



how much power was required to circulate the water in the system and to hoist the ore. From observations made with both the transparent model and the 40-ft. model, Mr. Gardner reports that no appreciable increase in power was observed after ore had been introduced into the circulation systems.

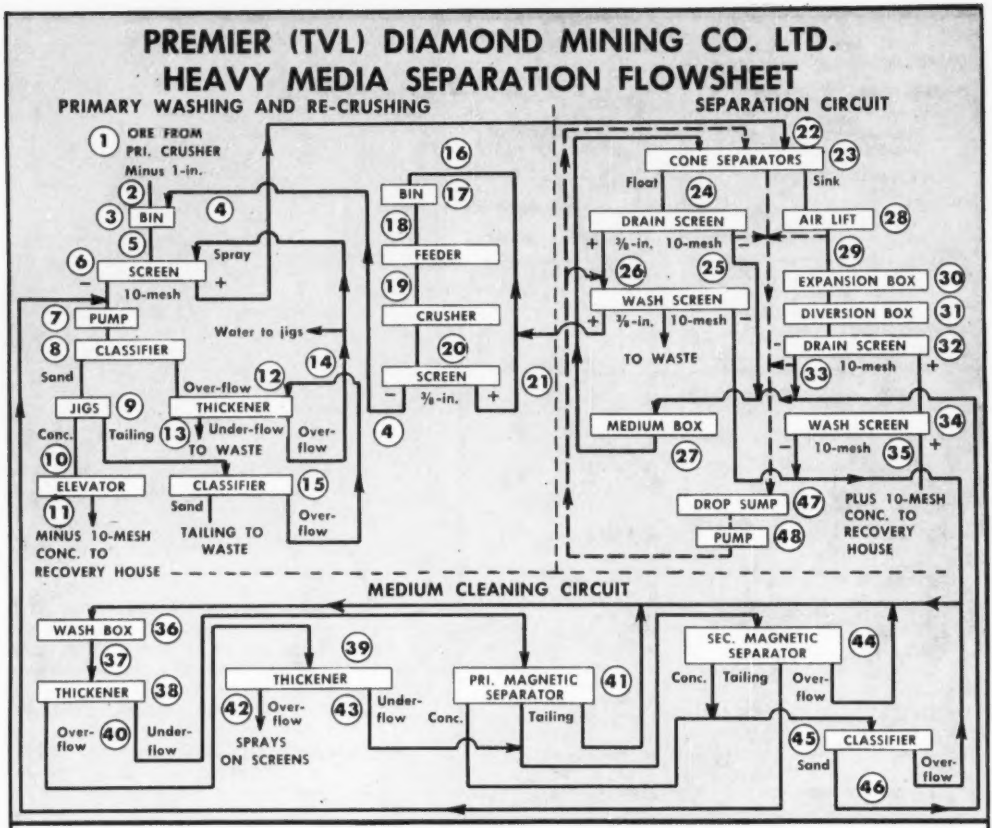
Ore does not teeter in the discharge columns, but moves out with surprising speed. There is no evidence of appreciable abrasion as one might expect when ore particles move at high speed through a pipe. This is due to the tendency of ore particles to move through the high-velocity center part of the pipe as indicated in the sketch above.

Mr. Gardner intends to conduct further experiments to demonstrate that the system shown in Installation II will work, and that over-all power requirements will be lower than one would ordinarily expect.



BOTTOM AND TOP ASSEMBLIES of transparent model used to study power requirements and movement of ore particles in water column.

PREMIER (TVL) DIAMOND MINING CO. LTD.
HEAVY MEDIA SEPARATION FLOWSHEET



LEGEND

1. Ore crushed underground to minus 6-in.; then crushed on surface to minus 1-in. in Symons cones.
2. "Adequate" weighers and belt tripper.
3. Surge bin, 1,500 tons.
4. Conveyor brings re-crushed product (minus ⅜-in.) over weigher.
5. Eight Syntron vibrating feeders.
6. Eight Allis-Chalmers low-head screens, 5x16-ft., double-deck, ⅜-in. and 10-mesh.
7. Eight ERG sand pumps, 6-in.; four are standby.
8. Four duplex rake classifiers for de-sliming, 8x18-ft.
9. Eight Denver 2-cell jigs, 24x36-in.
10. Four bucket elevators.
11. Conveyor to recovery house, grease tables used to recover diamonds.
12. Two traction thickeners, 100-ft.
13. Four Dorrco Triplex diaphragm pumps, 4-in., delivering to one 5-in. Spargo rubber-lined sand pump, one standby.
14. Pulsometer spray pump, 3,000 gpm.; one standby.
15. Four dewatering rake classifiers, 8x18-ft.
16. Two-way reversible belt tripper.
17. Re-crush feed bin, 600-ton.
18. Three retractable belt feeders.
19. Three 5½-ft. Symons Short-head crushers.
20. Three Symons rod-deck screens, ⅜-in.
21. Belt conveyor joins conveyor from float wash screen.
22. Four cone feed conveyors, 30-in. Also four "Adequate" weighers.
23. Four 16-ft. diameter separating cones.
24. Medium drainage screens for float; eight Allis-Chalmers lowhead, 5x16-ft.; top decks are ⅜-in. square mesh, lower decks are 10-mesh stainless steel cloth.
25. Four Wilfley medium return pumps, 5-in.
26. Medium wash screens for float; eight Allis-Chalmers lowhead, 5x16-ft.; top decks are ⅜x1¼-in. slotted wire mesh, bottom decks are 10-mesh stainless steel wire cloth.
27. Four steady-head medium return boxes draining directly into cones.
28. Four 8-in. external airlifts for sink. Pressure is 55 psi., using 220 cfm., from three ½-in. jets in airlift pipe. Possible to use ⅜-in. jets, however.
29. Milliken blow-back valves, 8-in.
30. Four expansion boxes for airlift to release air.
31. Four diversion boxes to permit returning sink to cone if necessary.
32. Four sink drainage screens; Symons single deck, 3x10-ft., 10-mesh stainless steel cloth, short protection deck at feed end, ½-in. wire mesh.
33. Four medium return pumps, 5-in. Wilfley.
34. Four sink wash screens; Symons single-deck, 3x10-ft., 10-mesh stainless steel cloth.
35. Conveyor and weigher, to concentrate recovery house.
36. Wash collection boxes, screen protected.
37. Magnetizing blocks, 12-in.
38. Four primary thickeners, 6x20-ft.
39. Two secondary thickeners, 6x40-ft.
40. Eight 4-in. ERG sand pumps, four standby.
41. Five 48-in. Dings primary magnetic separators.
42. Two Pulsometer spray pumps, 10-in.
43. Four 2-in. ERG sand pumps, two standby.
44. Four 48-in. Dings secondary magnetic separators.
45. Four Akins densifiers, 48-in.
46. Four de-magnetizing coils.
47. Four conical drop sumps, built into concrete foundation of building. Each holds one cone charge.
48. Two 4-in. ERG sand pumps.

SURFACE PLANT of Premier Diamond Mining Co., Ltd., at Cullinan, Transvaal, South Africa, now treating 12,800 tons daily of diamond-bearing "blue ground." Operation started earlier this year.

How Heavy-Media Separation Recovers African Diamonds

IAN F. CAIRNS*

Johannesburg, South Africa

IN FEBRUARY OF THIS YEAR, Premier mine's 12,800-ton-per-day heavy-density separation plant went into production at Cullinan, Transvaal, some 22 miles east of Pretoria.

The successful start of this plant was the climax of five years' laboratory and pilot plant research on the part of the Anglo American Corporation of S. A. Ltd., consulting engineers to De Beers Corporation, who control Premier mine. The 100-tons-per-hour pilot plant which went into production in June, 1947, was the first plant of its kind in Africa, and was the first commercial application of heavy-density separation to the concentration of diamonds.

Established practice in diamond concentration in this country has been confined to two methods, namely:

1. Treatment of the crushed "blue ground" in one or two diamond pans in series, often with a recrush step between primary and secondary pans. Pan concentrates are closely sized on screens and further concentrated in jigs. The diamonds in the jig concentrates are then recovered by passing the concentrates over grease tables. The diamonds stick to the grease, and are recovered by scraping the surface grease off the tables and melting this in hot water.

2. The crushed ore, or diamond bearing gravels, are sent direct, or after sizing, to jigs of the Hartz or Pleitz types. Jig concentrates are then treated as described.

The method employing diamond pans is probably the more efficient, but its use is dependent on the existence in the crushed ore of sufficient primary slime to form a "puddle" with water in the pans. This "puddle" might be likened to an autogenous dense medium, but operating density is only of the order of 1.3. It is possible, of course, to produce an artificial puddle by grinding a fraction of the blue ground, or other rock, to give sufficient fine slime.

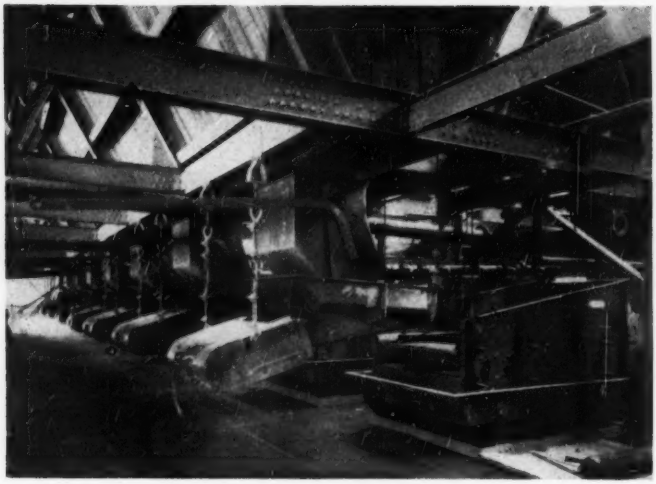
The ground in the upper or weathered zone of most kimberlite pipes is eminently suitable for treatment in diamond pans. Prior to the shutdown of the Premier mine in 1932, during the depression, the orebody had been worked to a depth of over 500 ft. by open-cast methods. The blue ground below the weathered zone was not amenable to pan treatment, and recovery was by jigs.

In 1944, the consulting metallurgist for Anglo American Corporation became interested in the possibility of using HMS for diamond concentration. By mid-1945, a 20-in. laboratory cone plant had been obtained and a long and exhaustive test program was initiated, using ferrosilicon medium. The work was carried out on various blue ground ores at the De Beers Consolidated Mines, Kimberly, Cape Province, which mines were then in production.

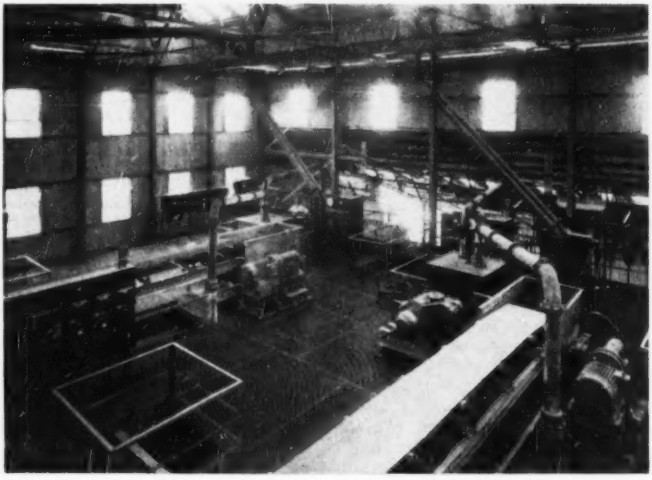
It should be appreciated that any small scale testing of diamond blue ground is unique in several respects, e.g., the diamond content of the original ore represents a concentration of the order of 12 million to one. Moreover, there is no analytical process whereby values of products may be readily determined. As a result, head samples have to be salted with diamonds or other minerals of similar specific gravity, and to determine the efficiency of any concentration process, products have either to be passed over grease tables or laboriously hand-sorted.

The laboratory test program posed many problems and headaches, but results provided sufficient encouragement to test the process on a commercial scale. The

*Metallurgical engineer, Fraser & Chalmers, Johannesburg, South Africa.



FEED IS WASHED on battery of Allis-Chalmers double-deck screens fed by Syntron vibrators. Minus 10-mesh material goes to jigs.



CAREFUL DESIGN is evident in this layout of two cone units. Belts feed cones underneath grating floor. Two boxes beyond the belts are provided for returning the medium to the cone.

design of a 100-ton-per-hour pilot plant for Premier mine was begun in 1946, and the plant, a 12-ft. cone unit, went into production in January, 1947. No one in South Africa knew much at the time about operating a plant of this sort, and it was a tribute to all concerned that within a few months "teething troubles" were ironed out, an operating crew was trained, and the plant was going at full capacity.

By April, 1948, the economics and results of heavy-density separation as applied to Premier mine ground had proved attractive, and a decision was made to install the 12,800-ton-per-day plant.

Plant design was started in May, 1948. Erection on prepared foundations started towards the end of June, 1949.

The first unit went into production on Feb. 25, 1950, and the completed plant was handed over to the mining company on May 10, 1950. Complete design and fabrication was done locally.

Ore is crushed underground to a minus 6-in. product and delivered via a shaft to a surface stockpile.

Crushing is done in Symons crushers to a nominal minus 1-in. product, closed circuit crushing being avoided to minimize the chance of an occasional large diamond being shattered.

Crushed ore is sent via a 1,500-ton surge bin to a battery of double-deck primary wash screens, on which the minus 10-mesh product is removed. The minus 10-mesh product is deslimed and the sands concentrated on Denver mineral jigs. The slimes gravitate to traction thickeners from which the underflow is pumped to a slimes dam and the overflow is returned as wash water to the screens.

Size of Feed

Cone feed is thus minus 1-in. plus 10 mesh. Float screens are fitted with $\frac{3}{8}$-in. top decks and 10-mesh bottom decks. Float oversize, plus $\frac{3}{8}$-in. material, is sent to the recrush plant where Symons crushers operating in closed circuit with rod deck screens reduce the product to minus $\frac{3}{8}$ in. This product is returned to the surge bin ahead of the primary washing screens. Feed to the cone is thus original minus 1-in. plus 10 mesh, plus a circulating load amounting to some 40% of new feed.

Plant tailings are therefore all minus $\frac{3}{8}$-in. Original feed could, of course, all be crushed to minus $\frac{3}{8}$ in. before feeding to the cone, but as stated earlier, this is avoided as valuable diamonds would be shattered. By feeding minus 1-in. ground to the cones, all free diamonds report as sink, and small diamonds that remain locked in the minus 1-in., plus $\frac{3}{8}$-in. material, amounting to some 8-10% of output, are released in the recrush circuit and returned to the cone.

Sink screens have single decks dressed with 10 mesh stainless cloth. It should be appreciated that all diamonds in the sink product are "free" and that the heavy minerals reporting with the diamonds are not diamond bearing. In other words, there is no necessity to recrush coarse sink and all sink product goes by conveyors to sizing screens and vibrating grease tables in the recovery house.

Sink averages around 5% of cone feed, but varies up to around 10% with ore from some sections of the pipe. Medium is ferrosilicon, and cone gravities are maintained around 2.90 top and 3.05 bottom.

Normal plant operation is on a three shift basis, six days per week.

To allow for normal stoppages, plant maintenance, etc., design of the heavy-density plant was based on a peak load rating calculated on a 20-hr. operating day.

The primary washing and heavy-density sections of the plant comprise four identical units.

On this basis, design of the various units was based on the figures shown in Table I.

TABLE I—Designed peak tonnages at various points in Premier's heavy-density flowsheet. In tons per hour.

	Per Unit	Total Plant
New feed to 1,500-ton surge bin	160	640
Recrush product to surge bin	64	256
Minus 10-mesh product removed on wash screens	32	128
Tonnage to cones	192	768

Nominal minus 1-in. feed from the crusher plant is fed to a 1,500-ton bin by means of conveyors and a Stephens-Adamson two-way traveling belt tripper.

Washing is done on eight double-decked low-head screens fed from the bin by eight Syntron heavy-duty vibrating feeders. Top decks are dressed with ⅜-in. square wire mesh and bottom decks with 10-mesh stainless steel cloth.

The minus 10-mesh product from each pair of screens is deslimed, and the sands are sent to two 24x 36-in. Denver mineral jigs. Jig concentrate carrying minus 10-mesh diamonds is continuously removed by bucket elevator and sent to the diamond recovery house by means of a series of conveyors.

The Cone Circuit

The heavy-density plant comprises four identical 16-ft. diameter cone units, each with its own ancillary equipment. The cones are fitted with 8-in. external air lifts. Diving rings have been retained. Their diameter is 6 ft. 6 in. To overcome any possibility of rafting within the diving ring, the center line of the feed belt head pulley is some 12 ft. above the pulp level in the cone.

Cone feed is prewetted in the feed chute by medium bypassed from a circulating medium line. Cone rakes are reversible and operate at 3.75 rpm. The airlift elbow has three ½-in. air jets, two of which are in use during normal operation. Air lift pressure is 55 psi., at which pressure some 220 cfm. of free air is used. This is more air than is required, and ⅜-in. air jets have been supplied and will be substituted. Two 1-in. boiling valves are fitted near the apex of the cone for use when required. Maximum available pressure from the mine compressors is 75-80 psi.

Medium return pumps deliver to a steady head box, the top of which is 12 ft. above the cone overflow level. This entails the use of some additional power for the pumps but gives a positive head on the "organ pipe" distribution lines. The 8-in. air-lift upcomer has an isolating valve on the cone floor level to permit blowing back into the cone. This valve has a circular 8-in. port. Delivery of the air lift is through an expansion box fitted with air release, to a diverting box feeding the sink screen or back into the cone when necessary.

Float and sink screens are described in the flowsheet. All screen hoppers are fitted with ½-in. thick punched plate with ¼-in. holes, as protection against screen breakage. Hopper sides have detachable side plates above the protection plates. All hoppers are lined with Linatex rubber.

Medium return pumps are 5-in. Wilfley model "CB." Float pumps operate with a double suction intake, the pumps being located centrally between the two float drain hoppers. This allows a considerable saving in height over bringing the two float drain hoppers into a common sump and feeding the pumps through a single suction intake.

Under normal operating conditions little, if any, medium is cut to the cleaning circuit by means of the medium deflecting trays. The surface character of the ore is such that sufficient medium is carried over by the float and sink products, to be washed off on the wash screens and thence to the cleaning circuit, to keep the medium sufficiently clean to obviate viscosity troubles in the cone. Medium through the cleaning circuit is around 15% of ore feed rate to the cone.

Medium Cleaning Circuit

The cleaning circuit for each unit comprises a 20x6-ft. primary thickener, 4-in. ERG underflow pumps, one 48-in. primary Crockett magnetic separator, a 48-in. secondary separator and a 48-in. densifier. Overflow from the primary thickener is further settled in a 40-ft. secondary thickener. There are only two 40-ft. thickeners, each taking the overflow from two 20-ft. thickeners.

Underflow from the primary thickener is pumped to the primary magnetic separator and that from the secondary is pumped by a 2-in. ERG sand pump to the secondary magnetic separators of two units. Secondary Crockett tails gravitate to the minus 10-mesh pump sumps in the primary wash circuit. Feed to the primary thickeners from the wash screens is by launders to two collection boxes, with punch plate protection screens, positioned above and on either side of the thickener. From these boxes, medium for cleaning gravitates through 12-in. magnetizing blocks to the thickener feed well. Magnetizing blocks are electrically excited, but these will probably be changed to permanent magnetic type.

Densifiers were set at 3 in. per ft. slope before startup, and concrete false bottoms were run in. The latter prevents needless lockup of settled ferrosilicon and prevents side scour. Densifier rake product passes through a demagnetizing coil before entering the sink medium return hopper.

In No. 1 unit, two primary Crocketts were installed in parallel and medium loss in this circuit will be compared with that of the other units. Space for a second primary Crockett was provided for if necessary in the other circuits.

Secondary thickeners overflow to a concrete sump. Overflow is pumped by 10-in. solution pumps to the float and sink screen sprays. Pump suction is protected from floating trash by large area fine mesh screens. The last few sprays on each wash screen have alternative fresh water connections. The type of spray used was developed at the mine and consists of a 2-in. pipe with holes at 3-in. centers. Water from the holes hits a deflecting plate welded to the pipe and gives a straight line spray which is set against the flow of material over the screen. The sprays work well so long as the pump suction is protected against wood chips, etc.

Novel conical drop sumps were provided in this plant, one for each cone. The sumps are in concrete, 60-deg. sides, and were built in as

part of the plant foundations. Each has the capacity of one cone charge. Sumps have a protection grid of 1¼-in. square egg-crate flooring with ¾-in. square wire mesh welded over it. This grid is secured to a supporting steel framework 4 ft. from the top of the sump and keeps coarse material out of the pump when a charge is dropped. Agitation for the dropped charge is provided by a 1-in. high pressure air connection in the bottom casting of the sump and when charge is being pumped out by a 1-in. air line running down the side of the sump and terminating in a ring main with punched holes some 18 in. above the sump apex.

One 4-in. ERG sand pump serves two drop sumps and delivers the charge either back to its respective cone direct or over its float wash screen. After use, pump delivery line must be thoroughly flushed out. With ferrosilicon only, the total charge can be returned to the cone in about 20 minutes.

Plant Control

Each cone unit has its "A" electrical control panel, from which the total circuit can be started or stopped by push button control. Control panels are located on the operating floor above the cones and opposite air control manifolds. Panels are fitted with red and green indicator lights for each motor and, in addition, any motor cutting out sounds a klaxon horn. The panels also carry the Syntron feeder rheostats, cone feed indicator dial and float and sink medium pump ammeters. Individual motor starters are grouped in convenient panels adjacent to their driven units.

One "B" control panel situated on the operating floor between Nos. 3 and 4 units provides remote control for all items of equipment common to all four units, e.g., dirty and fresh water spray pumps, tailings, concentrates and recrush circuit belts, etc.

Direct current at 250 v. is generated in a 35-kw. motor generator with standby located on the primary Crockett floor. An adjacent control panel for the magnetizing blocks of all units is provided. Crocketts have individual control panels. Direct current cutting out on a Crockett gives audible warning on a buzzer, and with the secondary machines, tailings are diverted to the medium thickener by means of a solenoid control. Belt stoppage on a Crockett gives warning through the "A" control panel. Demagnetizing coils are interlocked with the densifiers and the latter cannot be started until the demagnetizing coils are energized. Electric failure of a demagnetizing coil operates an electric bell.

Expanded Metal Floors

All floors throughout the plant are made of prefabricated egg-crate panels attached to the floor girders. This assists natural lighting of the plant and any spill drops to the bottom concrete floor. This type of flooring has the disadvantage that any unattended or persistent drip or spill tends to deposit on equipment directly below on the lower floors. Cones and primary thickeners are also covered with crating.

Cone density control is manual at present but an automatic recording density meter will be tried out on one unit shortly.

Float oversize is carried by belt conveyor system with tripper to a 600-ton crusher surge bin. Three 5½-ft. fine bowl Symons Short-Head crushers were installed, with provision for a fourth, if required. Each crusher is in closed circuit with a 5x8-ft. rod deck screen with ⅜-in. rod spacing. Oversize is returned to the surge bin and undersize is sent to the 1,500-ton bin in the primary wash circuit. Crushers are fed by means of retractable carriage, horizontal belt feeders. Crusher discharges onto a short inclined belt feeder delivering to the rod deck screens. The moisture in the crusher feed tends to form pancakes of agglomerated fines, but the proportion is small and there is no build up of these.

Crushers are directly connected through flexible couplings to slow speed motors, and are protected against a drop in oil pressure or cutting out of the oil pumps by Mercoid relays. The whole circuit is interlocked so that in the event of a stoppage of equipment after the crusher, feed to the crusher stops first and the crusher runs 60 sec. to clear itself before shutting down automatically. Remote control, indicator lights and aural warning of a cutout are all provided.

Tailings Disposal

Plant tailings, minus ⅜-in., are delivered by 36-in. conveyor to a 300-ton surge bin situated at the base of an old tailings dump some 130 ft. high, close to the plant. Minus 10-mesh tailings and diamond recovery house tailings join the HMS tailings for disposal. The 36-in. conveyors, 2,000 ft. in length, carry the tailings up and along the top of the dump to a transfer point from which transverse conveyors deliver the product to two conveyors spaced at 400-ft. centers as alternate disposal systems.

All conveyors up to this point are 36-in. belts running at 300 ft. per min. The last mentioned conveyors each deliver to a 30-in. hump-backed conveyor on rails, operating at 430 ft. per min., and this, in turn, delivers to a 30-in. shuttle conveyor on rails operating at 550 fpm.

Final disposal is through Stephens-Adamson-type belt throwers hung on the end of the shuttle. The short thrower belt has a speed of 2,400 ft. per min. and has a trajectory of some 50-60 ft. Throwers have a rated capacity of 700 tons per hour each. As the dump face advances, the conveyor preceding the hump backs is extended.

At the transfer point, a third and central disposal system is now being installed. This incorporates some modification on the other two systems. Instead of extending the conveyor preceding the hump backs by 38-ft. length sections as at present, additional belts will be interposed in 250-ft. lengths.

Plant Start-Up

The plant was brought into production in units, as and when they were completed. Blue ground was fed to the first unit during the last week of February and the completed plant was handed over by the contractors, Fraser & Chalmers (S. A.) Ltd., to the company on May 10, 1950.

The pilot plant was shut down just before operations started on the big plant, so a nucleus of trained HMS operators was available.

One interesting point was that the first cone and densifiers were charged with the full ferrosilicon charges, approximately 85 tons, in less than two hours. About 25 tons were charged directly from bags dumped on the operating levels and the balance was fed on to the cone feed belt at ground level.

Apart from the usual small mechanical adjustments, no major design changes were made in the layout and only two pump speeds were increased by 10%.

The ferrosilicon used is a locally manufactured product produced by African Metals Corporation and has proved very satisfactory. Local manufacture of ferrosilicon has been a considerable saving to the mining company.

Pressure and Rockburst

From a Practical Point of View

For many years a mine captain on the Witwatersrand and a former principal of the Government Miners' Training Schools in Johannesburg, the writer recently came to the United States. This article summarizes his views on the rockburst as it occurs in the gold mines of South Africa.

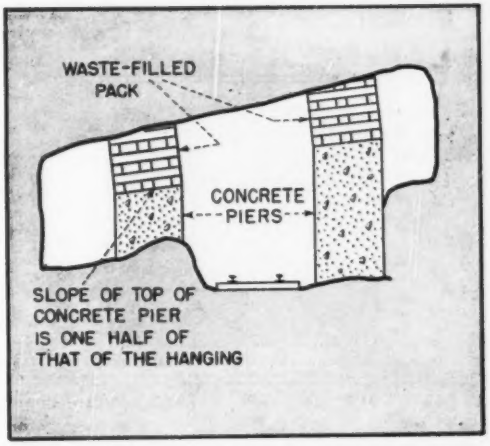


Fig. 1. SUPPORTS of this type, consisting in each case of a concrete pier two-thirds of the drift height topped by a waste-filled pack, have proved valuable on the Rand. They are spaced at intervals along drift.

M. L. JOHNSTON
New York, N. Y.

ROCKBURSTS are among the many problems arising from deep-level mining that beset the gold producers of the Rand. The growing strictness of safety regulations adds to the South African industry's burdens, already heavy by reason of increased wages, insurance premiums and maintenance costs. Under these conditions the possibility of bursts and the resultant casualties is always a matter of serious concern for the operator.

Another aspect of rockbursts, when dealt with on the old basis of sealing off the danger areas, is that of the loss of substantial orebodies thus caused and the fact that the cumulative effect of having several such sealed-off areas does not exclude the possibility of mine disasters in subsequent operation, but becomes eventually a new and increased source of danger with more violent and devastating results. At this stage, it is important to remember that the stronger the formation, the greater the accumulation of stresses and pressures, so that when a burst occurs, it is likely to be extremely violent. Pressure can be communicated through faulting, through dykes and, particularly, through remnant blocks to virgin areas, and thus cause bursts in development work such as drifts and raises.

Starting with these aspects in mind, operators have sought to make operation safer and cheaper, in respect to both production and maintenance. The problem caused by pressure exerting itself on orebodies and the surrounding rock has become a matter of major importance, which increases in direct proportion to the depth at which ore is being mined.

Safety and the maximum accessibility of remaining ore reserves being the main objectives of any planned mining procedure, it is obvious that it is necessary to eliminate the pressure areas instead of avoiding the problem.

Factors Determining Support

The main factors that determine the type of support necessary are, first, the stoping width; second, the structure of underground rock features, such as faulting, dykes, etc.; and, third, the rate of excavation. It is generally known that rock pressure increases with depth and that vertical pressure, particularly, is greater than the pressure exerted horizontally. The two pressures also vary considerably, depending on the situation and structure of the surrounding rock areas, the faulting, dykes, etc. In turn, these play an important part when plans are being made to mine a certain block.

The latter becomes important when the block is reduced to the final remnant stage. Experience has often shown that even a minor dyke of, say, 3 in. in thickness or a fault with as small a throw as 12 in. has caused a major burst with resultant loss of life. The principle of small causes and big effects is nowhere as valid as in underground pressure areas.

That stoping width is a factor in determining the support needed becomes clear if we realize that a longer bridge span requires both stronger bearers and pillars. As to faults and dykes, care should be taken that the final remnant blocks should be as far away as possible from any such features because they throw the balance into the realm of indeterminable stresses, and the pre-assessment of vertical and horizontal pressures and their relationship becomes blurred.

Which Block First?

In any confused stress area, therefore, the principle must be observed that in deciding which blocks are to be tackled first, working should be planned from the weaker stress areas towards the stronger natural and original stress areas. It is accepted today that bigger blocks have a sheltering effect on smaller ones in all stress areas. For example, on considering the size of an excavation which, by itself, causes certain stresses in the direction of the perimeter of the still intact rockbodies, it must be clear that, if a major block is left intact, it must have a sheltering effect on the surrounding smaller blocks.

And so we come to determine the

As the Mining of a Remnant Progresses

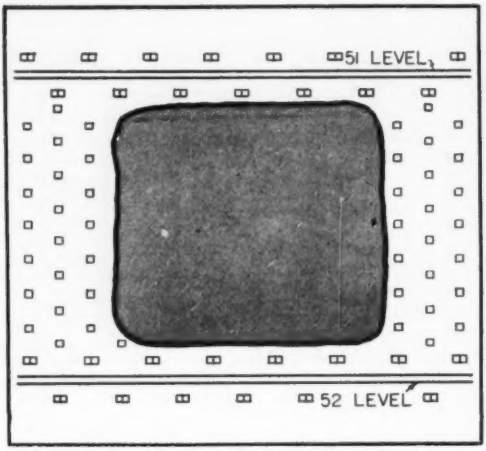


Fig. 2. REMNANT AREA showing drive above and below fully supported. Surrounding area has been timbered systematically and uniformly.

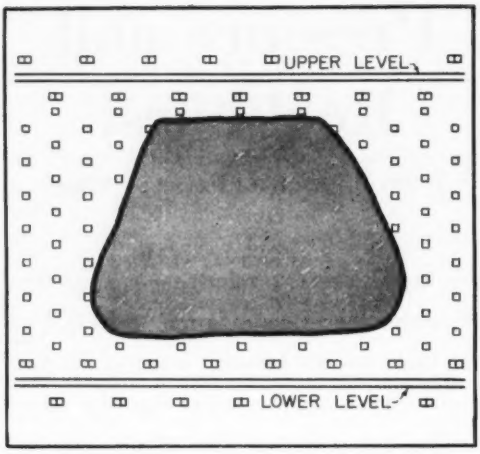


Fig. 3. FIRST STAGE in mining remnant area. Block is being mined faster at apex and timber lines are being changed to run more into face instead of parallel.

rate of excavation, this being the third factor determining the type of support. Here we face the final remnant blocks. If, at one extreme, the block is a big mass and shows no stresses, faulting, and dykes, we know today that a normal working pace is safe. At the other extreme, a small remnant block, showing stresses, faulting and dykes, would call for maximum speed in advancing the face.

Quick Action Needed

Many decisions must be made which require an alert mind and a thorough knowledge of the underground geological structure, as well as a complete familiarity with the general atmosphere and behavior of the excavated areas. Such decisions have to be made suddenly and followed through by the company management with prompt and energetic action.

Most bursts occur with the removal of or in the course of liquidating remnant blocks. This has been established by mine statistics and history, although little published material dealing with the point is available.

Attention, therefore, beyond the care ordinarily exercised in mining operations must be focussed on that part of the work which harbors the most danger, namely, the removal of remnant blocks. Here lies the key to the problem presented by this new and steadily increasing menace to the safety of the men, also the key to the problem of securing continuous profitable operation of any deep mining venture.

How these factors can be assessed and controlled and what progress has been made in recent years on the Rand will be dealt with in the remaining paragraphs of this article.

Control of Pressure Areas

Emphasis has been put on the danger that remnant blocks and their final removal constitute in mining. I will now discuss how such remnants are controlled and prepared to bring them to the final liquidation stage. In this attack on remnant blocks, complete knowledge of, even familiarity with, the geological structure of the mine is of major importance, if success is to be obtained.

The basis of all study of pressure problems is the fact that unless the pressure areas are dealt with effectively and the remnant blocks liquidated, the mine will lose a valuable ore reserve. Apart from this, the usual increase of pressure in most cases affects adjoining areas by turning them into stress-and-danger areas. This, in turn, exerts an adverse effect on haulage, traveling ways and sometimes even escapeways. Even if no pressure bursts occur, this is bound to have an adverse effect on the cost of maintenance.

In recent years it has been general practice on the Witwatersrand to give a remnant serious attention when it approaches a size, in area, of approximately 600 fathoms.* This block then becomes a candidate for final liquidation. The size of 600 fathoms or thereabouts is not a set figure, because the shape of the remnant block also plays an important part. As will be shown later, if the diagonal and cross-sectional dimensions are equal or almost equal, the remnant should be less of a risk than when they are in extreme proportions to each other. Finally, if these problems become apparent in an area adjoining another mine, the exact situation on the other side of the boundary line also must be ascertained. Logically, it is important to know whether there are any pressure areas, excavated areas or risky remnant blocks, which exercise any influence on the mining area on the other side of the boundary line, because the whole problem must be analyzed and solved as if the entire area were one single unit.

A Common Occurrence

Another circumstance which commonly happens on the Witwatersrand and elsewhere is that two reefs which are superimposed vertically may be mined simultaneously. Particular notice has been taken of this, in deciding whether one stope is to be stopped or, alternatively, one stope is to be driven well in advance of the other, as vertical pressure is usually unproportionately greater than horizontal pres-

*A fathom is 6 ft. by 6 ft. or 36 sq. ft.

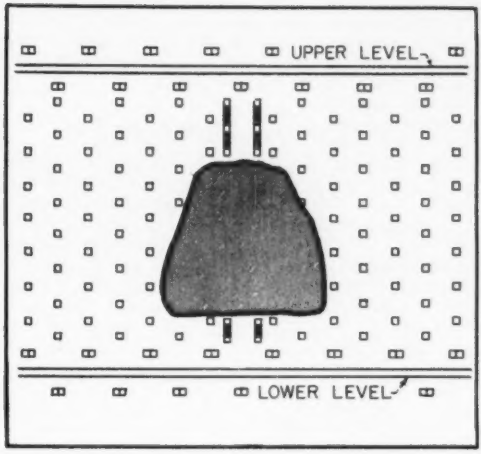


Fig. 4. SECOND STAGE in mining remnant shows how escapeways are being established above and below the block, as mining continues to shrink its size.

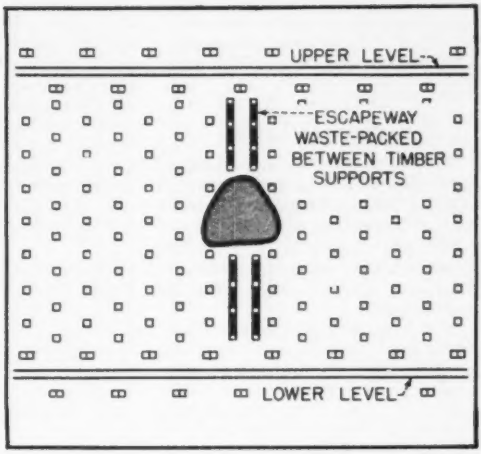


Fig. 5. IN THIRD AND FINAL STAGE, two different escapeways have to be kept open. They are usually waste-packed between timber supports as shown.

sure and their relationship to each other must receive the closest possible attention. In such areas, stoping should be done at a regular and consistent speed as a major consideration. It is also important to realize that internal development in such areas, when broken up by major faulting or dykes, is usually a somewhat risky undertaking, but such development work is sometimes almost unavoidable. Consequently, the planning is to be done with the utmost caution.

Efficient Tramming a Must

When all preliminaries have been complied with in such areas and the drives above and below are being prepared and supported, the main thought should be that efficient tramming and quick removal of the ore are going to be the foundation for consistent and steady stoping, that ventilation must be kept in first-class shape and, lastly, that escapeways are wide and adequate in the event of a burst.

Controlling the Sag

It is well known that once pressure is at work and evident, no form of support can withstand it, that even steel or solid concrete or any combination of both is hardly more than a waste of time and money. The only effective defense in such areas, which can control the rate of sag even if it does not eliminate it entirely, is to develop a uniform and consistent method of using timber as supports.

A procedure which has proved valuable, particularly on the Witwatersrand, is to stope out an area for about 8 ft. above and below the drift and to build concrete piers 8 ft. apart to two-thirds the height of the drift, as shown in Fig. 1. The top of these piers is given half the inclination of the hanging. Waste-filled packs are then built on each pier between its top and the hanging. The piers are spaced in checkerboard fashion.

Before any block would reach the stage when plans are to be made for eliminating it, the surrounding excavated area having been timbered systematically and in a uniform manner, usually in checkerboard fashion, it is evident that the hanging over the excavated area will have been given an even and well distributed sag to the greatest extent possible. The support is generally carried parallel to the stope face (see Fig. 2), but this progressively undergoes a change, as the block of ground is being mined faster at the apex. Because of this, the timber lines are changed and eventually run more into the face instead of remaining parallel. Consequently, as the face advances, timber is being put in, usually in a staggered manner, which makes it unnecessary to install an entire continuous line of timber at once, thus leaving a large open space parallel to the stope face at any time during operations.

The chief surveyor, who is constantly plotting the advance on the underground plans, usually has the task of dealing with remnants. He is familiar with the behavior of the workings. Moreover, he knows his personnel well enough to understand how to give instructions, assuring the best and safest execution of them. When a block is ready to be considered for final liquidation, he has plans drawn of the area. These he usually submits to the top mine official, who discusses the matter with the planning board of executives and consultants to determine what mining methods and safeguards are to be used.

The next step is to support all drifts in the area as completely as possible.

Determine the Shape

The shape the remnant is to keep is then determined. Special attention is paid to any sharp edges. These are always the weakest points and burst when pressure is mounting. The whole policy is to carry the remnant as well-rounded as possible.

A further consideration is that overhanging faces must be avoided. Pressure is usually evident at this stage and machine crews are frequently exposed to "slabbing" and "airbursting." In many cases it becomes necessary to do the drilling through hessian screens, which method gives a certain protection against "spitting" and "slabbing." Water on the stope face is supposed to be responsible for this "spitting."

Under all circumstances two dif-

ferent escapeways have to be kept open. They are usually wastepacked on either side between timber supports to increase the stability. (See Fig. 5.)

Reduce the Labor

At this stage it is recommended that labor should be limited, being reduced progressively as the process of liquidation unfolds. Eventually, the number of men is cut down to a bare minimum when the final stage of liquidation is reached in the area.

For this part of the operation, "gang logs" must be kept at a nearby safe place. These should contain all details as to the personnel working in the area. The workmen are checked at the beginning and end of each shift to show whether any are missing, should a burst occur. This avoids panic, when it is least wanted, and saves workmen who might otherwise waste time in needlessly looking for men thought to have been entombed.

At this critical stage, the workmen should be spread out as far as possible and should stay apart to the best of their ability.

Finally, the stoping width should never be reduced to less than about 42 in. In the event of a burst, workers having at their disposal such minimum stoping width would at least retain some hope of escape and also be able to aid in rescuing others.

Caution as to Drilling

A word also should be said here about drilling and blasting holes in a remnant area. By taking certain precautions, accidents have been greatly reduced in remnant areas. It is important that attention is being given to drilling and blasting in these areas. Holes drilled into the hanging wall or footwall cause stresses. Under certain circumstances these stresses can upset the whole equilibrium and cause uneven pressure in the area. This must be avoided or minimized.

All holes in remnant areas must break clean, even if it means breaking a smaller burden for each hole. Remnant faces must be drilled and blasted daily. That is, they must not be left standing, except after a burst when a certain working interval is ordered to let the affected area settle down completely before operations are resumed. These intervals are usually ordered for periods of 24 hours after the bursts have occurred.

Should drilling operations break down when only part of the drilling has been completed, blasting in that face should not be allowed the same day. Experience has shown that the concussion from the partial blast frequently causes uneven stresses and has resulted in very violent rockbursts, often with heavy loss of life to the following shift.

Watch Out for Signs

Detailed attention should be paid to any indications of impending bursts showing in the footwalls of drifts. Usually when these begin to develop, there are signs of lifting and distortion near and below the remnant, or the sag will be too rapid or it will lag. When such signs are showing, they mean "miner beware." The burst must then be brought on and expedited in the following manner: (it should be remembered here that bursts occur usually during or right after the blast). Holes are doubled up and spaced more closely than usual and utmost care must be taken that all holes are well overburdened and fully charged. In this way the desired burst is usually made to occur. The bigger the concussion, which in turn upsets the accumulated pressure and stresses, the more likelihood there is that these stresses will find relief in a burst.

Support in Excavated Areas

During the initial stages, supports are to be maintained in accordance with normal established standards valid for the area. In most cases they will be about 8 ft. apart for 42 in. stoping width, which is standard with most mines. When stresses and some sag become evident, timber centers are reduced in conformity with prevailing conditions, always with strict adherence to the principle of uniformity, to secure the best possible and most even distribution of stresses and sag. Progressively more and more sprags are being used to act as so-called "policemen," because they give ample warning of the rate of sag, as well as protection against local hanging.

In conclusion, I believe that, following the methods outlined and considering the facts mentioned, the problem of rockbursts and pressure bursts can be minimized and largely controlled. To eliminate this danger completely is hardly possible. It should be remembered that even the most perfect support system cannot prevent rockbursts entirely, while systematic timbering does give a well levelled off and distributed rate of sag and stresses, which in itself is a major prop for the whole theory.

Psychology's Part

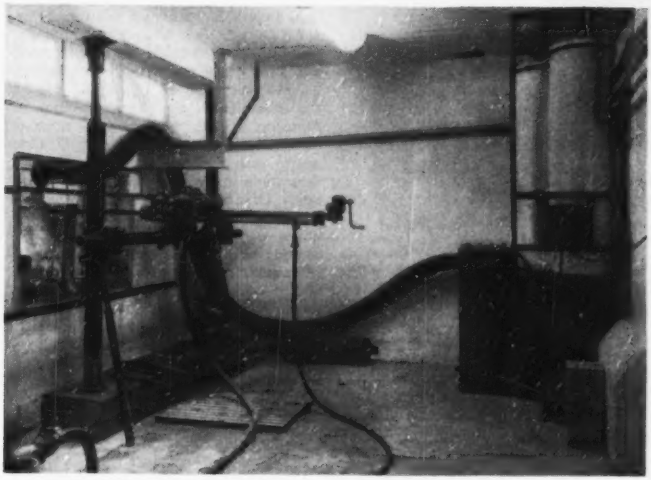
Experience has shown that psychology plays also an important part in the rockburst problem, especially in respect to remnant liquidation. Care should be taken to place experienced men at the head of mining gangs engaged in this dangerous work, men who can read the signs of danger showing mounting pressure, who know when to withdraw men from the affected areas before the disaster occurs. Only by constant screening can such men be found. There are others who feel they are hardened to the fear of danger, who have too much confidence and are inclined to ignore danger signs. Such men usually land themselves and their men in disaster. Lastly, there is the man who is overcautious and will withdraw his operatives at the slightest excuse, causing unnecessary panic and general uneasiness. The last results in slow progress and erratic mining. In the final stage this is particularly costly and therefore equally dangerous.

There are several problems which remain partly unsolved, despite the fact that they are the subject of constant investigation. It is yet to be proved, for instance, where the greater pressure is exerted, namely, whether by the sagging hanging wall or the vertical pressure exerted by the footwall.

Experience Counts

In respect to this problem, personal experience counts a great deal. I have made a close study of the problem in the course of removing many remnants. In most cases the footwall in the immediate vicinity of the remnant, especially in the drifts below it, will reveal vulnerable points. Invariably, it gives the first tell-tale signs of oncoming excessive pressure.

Competent men are wrestling with this problem. Strides have been made, but the day has not yet arrived when the danger is entirely eliminated. The constant effort to improve the statistics of mine accidents is a sign that progress is being made. Today miners are going underground with much more confidence than formerly. This confidence is based on their knowledge that science is working for them.



DRILLING IN TEST CHAMBER is conducted behind transparent doors of plastic that confine the dust during dry drilling and the water spray when drilling wet. At the same time a clear view of the work may be had.

Test Chamber for Diamond Drilling Experiments

R. S. YOUNG
Director of Research
Diamond Research Laboratory
Johannesburg, South Africa

DRILLING INVESTIGATIONS are an important part of the research program at the Diamond Research Laboratory in Johannesburg, an organization sponsored by the leading world producers to assist all users of diamonds. When the laboratory was built several years ago a small test chamber was designed in the basement for drilling experiments. Blocks of rock received by truck are lowered by means of a chain block into a pit 6x5x4½ ft. in dimensions, which leads directly into the drilling room in the basement.

One Variable at a Time

Such drilling variables as uniformity of rock, air pressure, or water pressure, which are a constant source of trouble under actual underground conditions, may be maintained constant within close limits. Attention can be concentrated, therefore, on a study of the one variable desired, whether it be type of diamond, setting of stones in the bit, composition of matrix, speed of the drill, or pressure on the bit.

It is realized that results obtained under such laboratory conditions often could not be applied directly to mine operations. For instance, only short holes can be drilled readily in a laboratory test pit, and the effect of vibration and other operating conditions in long-hole drilling are not readily brought to light in such a chamber. Nevertheless, the advantages it offers of close control over normal drilling variables and of rapid testing under technical supervision have shown this test chamber to be of great assistance in drilling investigations. Preliminary results of value can be obtained rapidly, and the most promising of them studied further under actual mining conditions.

Most diamond drilling is done wet, but occasionally it is necessary to drill dry. An interesting example is found in the Kimberley diamond mines where the presence of water causes the kimberlite to disintegrate gradually, with the occurrence of dangerous mud rushes. Many authorities also believe that dry drilling with adequate ventilation will be the answer to the problem of deep level mining in the gold fields of South Africa.

For Drilling Dry

For this reason an efficient dust extraction system had to be provided for our test chamber when dry drilling was done. The assembly is shown in the photograph. The pit has sliding doors of Perspex, which serve not only to retain dust when drilling dry and water spray during wet drilling, but also allow a clear view. The narrow opening between the doors through which the rods rotate is covered by a strip of rubber sheet. This effectively diverts the high velocity stream of coolant air returning outside the drill rods.

During wet drilling the water carrying the sludge runs from the pit through a covered channel in the basement floor to a sump. From here an automatic pump discharges it to the storm-water drains. The heavier sludge particles settle out before reaching the sump and are removed periodically from the channel.

During dry drilling the metal cover of the pit is closed. A dust-extractor system exhausts the air from the pit by means of a 6-in. flexible rubber hose connected to an exhaust fan. Between fan and hose is a metal box, 3x4x1¼ ft. in size, well baffled and filled with wood-wool to trap the larger dust particles. The fan has a capacity of approximately 2,000 cfm. at a pressure of 2 in. of water.

Dust Filtered Out

The air from the fan, carrying the finer dust particles, passes into a filter system of three flannel bags. The total area of these bags is 85 sq. ft., which proves effective in removing the finer particles. The entire dust-collecting assembly is provided with airtight trays to facilitate periodic removal of the dust. The unit is mounted on rubber pads to ensure relatively silent operation.

KEEPING TAB ON PRACTICE

Spread of Blast-Hole Diamond-Drilling Practice Checked. The advance in diamond prices has made it easy for manufacturers of rock bits with tungsten-carbide inserts to encroach upon the long-blasthole field, according to an informant who handles industrial stones. This person thinks, however, that there are not too many instances where the substitution has proved economical. Many new applications, in his opinion, have been found for long holes using carbide-insert rock bits, but in only a few instances have they actually taken the place of diamond bits. Their use, however, has definitely stopped the anticipated spread of blast-hole diamond drilling. The increase of these operations which all expected in 1946 has never taken place.

To check the situation quantitatively, a survey has recently been made by *E&MJ*. Of the mining companies, numbering about 50, who have used diamond drills for blast holes in the last 15 years, more than half report there has been no recent decline in footage drilled, aside from normal fluctuations. In fact, seven of this group cite material increases which they have made in diamond-drill footage. Of the balance, ten companies have curtailed such drilling or eliminated it, seven of them in favor of carbide drilling and jointed rods, the remaining three simply ascribing their action to high diamond costs. Four mines have been shut down, for reasons apparently not connected with drilling. No new users of blast-hole diamond drilling are listed. Data for 47 companies are given on this page.

Of the companies tabulated, 25 are in Canada, 17 in the U. S., 3 in Africa, and one each in Mexico and Australia.

A Quantitative Survey of Blast-Hole Diamond Drilling

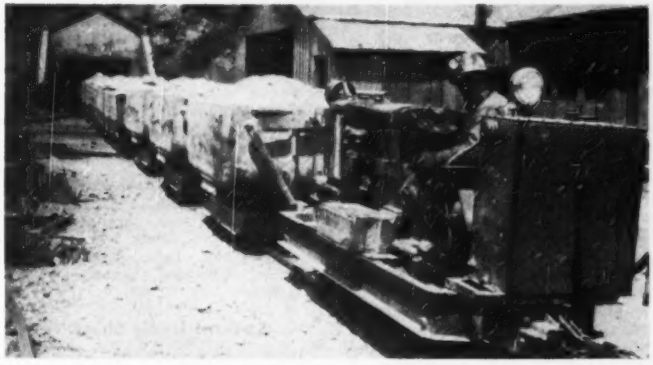
Company	Current Situation as to Diamond Drilling	Average Footage Recently	Average Footage Previously	Remarks
1	Eliminated.	None.	928/mo. (for 9 mos.).	
2	Curtailed.	1,259/mo.	3,847/mo.	
3	Much less.	500/mo.	5,000/mo.	Substituting long-hole carbide drilling, jointed rods.
4	Curtailed.	74,527/year, 1949.	63,044/year, 1948. 51,068/year, 1947. 99,820/year, 1946.	Decline in footage after 1946 due to substantial increases in diamond-drill contract prices in 1946 and 1947. At current prices, this method gives about the same costs as rock drilling with steel bits. Milling capacity was increased 30% in December, 1948. Footage per ton milled 0.314 (1946), 0.152 (1947), 0.183 (1948), and 0.165 (1949).
5	Used for all primary breaking in open stopes.			Increase in diamond costs has not raised total drill hole costs to prohibitive limits. Expect to continue use, as stated in Col. 2.
6	In use.	24,393/mo., Nov.-Feb., inclusive.	Lower a year ago.	
7	Tried, discontinued.			For 50- to 60-ft. blast holes in this ground percussion drills and jointed rods are cheaper.
8	In use.	75,000/mo.	Less.	Present footage 15% higher than year ago.
9	In use.	3,800/mo., 1949.	2,450/mo., 1948.	This drilling for sill removal only, varies as they become ready.
10	In use.	17,526/mo.		Gradually stepping up use of extension steel (19,328 ft./mo. in first quarter, 1950).
11	In use.	36,000/mo.	25,000/mo., year ago.	A year ago the mine was not ready to produce present mill tonnage.
12	Increasing.	45,519/year, 1949.	51,564/year, 1947. 29,426/year, 1948.	Footage drilled does not indicate rate at which ore was blasted.
13	In use.	500/mo.	500/mo., year ago.	Minimum footage necessary for pillar recovery is 500/mo. For stoping, a carbide bit and air-leg set-up give lowest cost.
14	Increasing.	199,065/year, 1949.	Footage rising.	
15	In use.	7,746/mo.	None, a year ago.	Mine on development only a year ago.
16	In use.	35,000/year, 1950 (est.).	49,267/year, 1949. 6,213/year, 1948.	Used chiefly in drilling pillars and sills, as available.
17	Mine closed.			
18	Eliminated.	None.	5,000/mo.	Previous footage is for year before changing to carbide and jointed rods.
19	Increasing.	97,000/mo.	57,000/mo., year ago.	Increase due to continued trend toward radial drilling and to decrease in burden (more holes).
20	Not available.			
21	Mine closed in 1947.		15,284/year, 1946.	1943—39,998 ft. 1944—36,116 ft. 1945—42,823 ft.
22	In use.	9,000/mo.	7,500/mo., 1949.	Increase is normal variation.
23	Unchanged.	See "Remarks."		Unchanged for 8 years. Footage varies greatly due to cycle of pillar recovery.
24	In use.	300/mo.	150/mo.	
25	Increased.	30,000/mo.	11,000/mo., 1949. 5,500/mo., 1948.	Increase due to change in stoping method, greater output, clean stoping walls, pillar reclamation.
26	Increasing.	9,000/mo.	8,700/mo., 1949. 7,300/mo., 1948.	Gradual increase in use of diamond drills.
27	In use.	8,600/mo.	7,000/mo., 1948.	30,000 ft./mo. in biggest year, 1941. Decrease due to change to pillar mining.
28	None.	None.		Drilled 1,800 ft. from Feb., 1942-Feb., 1943.
29	Eliminated.		See "Remarks."	Total footage was 20,000 ft., exclusive of pillars and remnants. Stopped because of higher cost, unsatisfactory technique, and unsuited to orebody.
30	Unchanged.	Unchanged.	Not available.	
31	Discontinued.	3,040 ft. (in last year).	Not given.	Discontinued in favor of carbide drilling with jointed rods.
32	Discontinued.		1,500/mo.	1,500 ft./mo. is for last 12-month period in which used.
33	Stopped.		Not given.	Did some a few years ago in narrow orebody now mined out.
34	Stopped.	None.	1,000/mo.	Stopped in favor of carbide bits.
35	Discontinued.	None.	Not given.	Stopped because of high cost.
36	In use.	6,500/mo.	7,000/mo.	Reduction due to high cost of bits.
37	Increased.	64,000/mo.	52,000/mo.	Due to increased production.

A Quantitative Survey of Blast-Hole Diamond Drilling (Continued)

Company	Current Situation as to Diamond Drilling	Average Footage Recently	Average Footage Previously	Remarks
38	In use.	250/mo.	250/mo.	Are replacing diamond drills with carbide bits on account of high diamond costs.
39	In use.	26,461/year, 1949.	Somewhat less.	More favorable areas have been mined out. Now confined mainly to mining pillars and in areas where back is bad. Some work with carbide drilling and jointed rods.
40	Mine closed.	None.	Insignificant.	
41	In use.	4,000/mo.	8,000/mo., year ago.	Physical characteristics of ore have changed.
42	Increased.	36,286/mo. (1st quarter, 1950).	28,216/mo., year ago.	
43	None.	None.	None.	Plan to start diamond drilling soon, also to use carbide drilling and jointed rods.
44	Discontinued.	None.	Not given.	Stopped years ago, owing to change in ore occurrence.
45	In use.	7,390/mo. (1st quarter, 1950).	10,468/mo. (1st quarter, 1949).	Difference due to lack of drilling places.
46	In use.	7,650/mo., (1st 2 mos., 1950).	9,740/mo., 1949. 13,536/mo., 1948.	Change due to combination of circumstances. Likely to increase, to exceed footage in 1948.
47	In use.	1,846/mo., for 12 mos.	2,179/mo., 1949; 2,700/mo., for 1948.	Considered as unchanged.

Radio for Underground Asbestos Mine. Canadian Johns-Manville, at Asbestos, Quebec, is laying out a two-way radio communication scheme for dispatching in its underground haulage system. (The company does not use radio in its open pit.) According to Charles D. Borror, plant engineer, there were no communication radio sets developed which would meet the company's condition due to magnetite in the orebody and other local disturbances. They have, therefore, purchased tank or airplane sets from War Assets and their engineers are developing circuits which will be suitable for their use. Actually, they are using the trolley lines as carrier cables. The radio impulse is projected from the sending set and is picked up by the trolley line a few feet away, and then picked from the trolley line by the sets in the dispatcher's station and vice versa. In this manner, they have to use the ether as a carrying medium for only a few feet.

A pair of test sets has been developed for this purpose, and the other sets, which will be placed on the locomotives, are being rewired.



THE DIESEL-DRIVEN mine locomotive installed in 1942 in the limestone mine of Great Western Sugar Co., Horse Creek, Wyo., (*E&MJ*, July, 1950, p. 82) is shown in the accompanying picture. This 5-ton unit is seen hauling nine loaded cars, each weighing 3 tons and carrying 5 tons. It is handling approximately 700 tons per day, the distance from portal to loading point being approximately one mile. On the rear of the locomotive is seen the exhaust-gas conditioner, of stainless steel. As stated in the July issue (p. 82), this mine has another diesel locomotive also, installed in 1948. (*E&MJ* thus far has been unable to discover a mine diesel locomotive of any other make than that of the Ruth Co. in underground mines in this country operated by domestic mining companies).

Steel for Roof Bolting. Tennessee Coal, Iron & Railroad Co., employs a good rivet-grade of steel for the bolts used in the "pinned-up" mine-roof supports it is installing in its Birmingham district iron and coal mines (*E&MJ*, July, 1950, p. 83). This steel provides a minimum ultimate strength of 56,000 psi., assuring that a 1-in. bolt will support 33,600 lb. of roof on its threaded end and 44,000 lb. on its anchored end. To produce a bolt design that would consistently provide enough anchorage strength to develop the full tensile strength of the bolt, tests were made on various designs and sizes of wedges, rods and holes. After installation, the test bolts were pulled by a hydraulic jack rig until they broke and the tensile strengths were noted.

More on Rotary Carbide-Tipped Stems. The tungsten-carbide bits used with the high-speed rotary electric drills at the Umvukwe chrome ore mines in Southern Rhodesia (*E&MJ*, July, 1950, p. 83) are made by manufacturers in Great Britain and in the Union of South Africa (Consolidated, Victor and others). They are of the standard type used in British and South African coal mines. (Efforts to tip auger rods with carbide have not been successful). They are detachable, the shank of the bit fitting into a recess in the rod end. A small nail through the rod holds the bit in place. Spirals butting against shoulders on the bit keep it from rotating on the rod.

In shape, the bit is like the diamond-drill fish-tail bits having cutting edges of tungsten carbide. The two wings are brought to points at the ends. If these points run in the same groove, the bit is called "concentric." If they cut separate grooves, it is "eccentric." The term "rake," also used in *E&MJ*, July, 1950, p. 83, refers to the angle of the two tails with relation to the hole. If the tails lean in the direction of rotation, the rake is called "positive"; if in the opposite, the rake is "negative."

"Umvukwe chrome mines" refers to all of the chrome mines on the northern end of the Great Dyke in Southern Rhodesia. African Chrome Mines, Ltd., is one of the operating companies. The general manager is G. H. Parkinson, Box 124, Selukwe, Southern Rhodesia.

WASHINGTON REFLECTIONS

Seabrook Hull, McGraw-Hill Washington News Bureau

Korea Fighting Spurs Stockpiling Activity, Reduces Price Quibbling; Annual Report Cites Accomplishments and Revisions

WAR IN KOREA, bringing with it the threat of more outbreaks elsewhere, and maybe even World War III, changes the whole complexion of the U. S. critical materials stockpiling program.

Before, price was a major factor. Stockpilers were as much interested in getting the most for their dollars as they were in completing their goals.

The aim now is to buy as much as possible, with much less regard to price. There are even some signs that stockpile buying may be used to prevent strategic materials from falling into enemy hands. Rubber is a prime example.

Before, stockpilers were careful not to buy heavily where it might push up prices or interfere with supplies for industry.

From now on that will be a secondary consideration. A full stockpile for any emergency is the answer sought today. Speed in completion of the objectives is considered imperative.

Under the old plan—based on the buying rate to date—completion of the stockpile would be impossible much before 1956. Even then there would probably be some gaps.

However, the year-end (fiscal 1950) report of the Munitions Board to Congress gives a good picture of the current situation in critical materials. In it are both good and bad news for the domestic mining industry.

Government is constantly seeking new U. S. sources of strategic items, but at the same time both industry and Government researchers are seeking new substitutes for them. Sometimes the substitutes are other mineral materials that just happen to be more plentiful, but often they are plastics—products of industries whose raw materials are easily procured.

One thing that stockpilers constantly emphasize is the fact that preparedness in time of war is the prime objective of defense planners—the good or bad effects on any industry notwithstanding. As we move closer to war, this aspect of policy becomes more noticeable.

Revised Objectives

As shown in the annual report, the materials and quantities of each are subject to almost continual survey and revision. In the past year stockpiles of some materials have been completed; other materials have been dropped; some added; and some are way short of their objectives.

Pepper, rutile, and the two zirconium ores, baddeleyite and zircon have been dropped completely. No new purchases are planned, but stocks on hand will be retained, for the present at least.

Objectives have been revised on 14 other materials. For this group the program is either complete or almost so. In any event, purchases are either limited or have been canceled entirely. These materials are: liquated antimony, and antimony ore, metal grade bauxite, celestite, emetine, amorphous lump graphite, hyoscine, iodine, lead, mica (muscovite splittings), quinine, rutile, and sperm oil.

On another group, purchases have been halted completely and no new objectives set. Included are agar, chromite, mercury, tantalite, and vanadium.

Several Items Short

Today's most important aspect of stockpiling however is the shortages. It is here that the U. S. might be in trouble in another war anytime soon. Present stockpile supplies on hand fall far short in the case of rubber, copper, zinc, tin, and manganese—perhaps others. They are the same materials that have been tight for industry.

Stockpilers steered clear of too heavy purchases to assure an adequate flow to industry, and so as not to drive already rising prices even higher.

In the case of tin, contracts in hand now will go a long way towards raising emergency supplies of this material up close to current goals. Negotiations were delayed last year by late Congressional action on the Appropriation Bill and Senator Thomas' (Okla.) attack on the stockpiling program.

Meanwhile, another 100 additional materials are being reviewed with an eye towards adding some or all to the stockpile. These are materials for which no goals have been set.

Actually, overall, on July 1, 1950, there were on hand in the stockpile $1,556.2-million worth or 38.4% of current objectives. In addition, there was on order, another $494.9-million worth or 12.2%. Fulfillment of these would bring acquisitions to the halfway mark.

This year's goal was, before Korea, to bring the national stockpile to 68% completion by June 31, 1951. The war in Korea will undoubtedly call for these aims to be revised upwards.

Several Agencies

In building up the stockpile, the Munitions Board makes direct use of six Government bureaus and departments.

Actually, the Federal Supply Service does most of the buying, having let $680.4 million in purchase contracts over the last year. At the same time it was offered $28.4 million of surplus materials for the stockpile, of which $24.8 million were accepted. These included lead batteries, cartridge cases, copper, zinc, low-grade manganese ore, and narcotics.

Even the General Services Administration had a hand in building up critical materials supplies. In this case it was 97 million pounds of primary aluminum, received as payment under lease and sales contracts with Kaiser Aluminum & Chemical Corp., and Reynolds Metals Co.

ECA, State, and Commerce

ECA, whose counterpart funds earlier were expected to be a large source of strategic materials, came through with a scant $13.1 million of sisal, rubber, platinum, quinidine, industrial diamonds, fluorspar, and beryl.

During this same period, however, ECA approved over $16 million (both counterpart funds and dollars) in strategic materials development projects, with repayment to be out of production. Similar projects are pending for another $20.4 million in ECA dollars and $46.7 million in counterpart funds. Approval is expected shortly. All contracts will have clauses calling for repayment in strategic materials, including aluminum, bauxite, chromite, cadmium, columbite, graphite, tantalite, and tin.

State Department's role consists primarily of that of negotiator. They pave the way for signing contracts, but don't actually do any buying of materials.

Commerce Department's job is one of assisting in determinations of what and how much will be needed and how rapidly it should be bought.

Department of Agriculture's Commodity Credit Corp.—which runs the Farm Subsidy Program—is authorized to exchange surplus agricultural commodities for wanted materials. CCC's only accomplishment to date is the exchange of 160,000 bushels of corn for metallurgical chromite.

CCC reports many offers to do business, but in too many cases would be traders expected give-away prices on the agricultural commodities, and in others the materials offered in trade were not on the stockpile list.

Substitution Activity

Mixed up in the field of conservation and substitution are as many different Government agencies as are engaged in procurement.

You see such things as these resulting from research in this field:

1. The substitution of magnesium for the rare metal cerium in the production of nodular iron.
2. The substitution of natural asbestos and mica by fibrous glass and synthetic mica.
3. The development of miniature circuits to do the same job as big ones, thus saving copper and other metals.
4. Experiments in nitriding as an anti-corrosion coating to replace cobalt, chrome, molybdenum.
5. The development of titanium to replace stainless steel.
6. Research into the best way to recover manganese from low-grade ores and slags; continued search for domestic sources.
7. Possible substitution of Virginia mullite for India kyanite; and carborundum Co.'s Mulfrax for Kenya kyanite.
8. Continual and occasionally successful searches for new domestic sources of graphite, mica, talc, beryl, columbite, tantalite, monazite, tungsten, quartz crystals, bauxite, copper, mercury, lead, zinc, vanadium, fluorspar.

The recovery of metal from scrap and waste products, and as well, investigations into the best ways to recover thallium, germanium, gallium, and indium, all of which show promise of greater usefulness in various ways, such as the use of liquid gallium as a heat transfer agent for atomic power piles.

Brief, but Important

ECA PURCHASES—ECA contribution to U. S. mining industry export totals for the period, April 3, 1948—June 30, 1950, totals $592 million authorized for U. S. purchases of nonferrous metals, metallic ores and concentrates, coal, non-metallic minerals, mining machinery and equipment. Of that $430 million had actually been shipped and paid for.

Of the authorized figure, $154 million went for non-ferrous metals; $11.9 million for metallic ores and concentrates; $181 million for coal;

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News-Bureau

MANPOWER: Look for a new policy statement on deferment of skilled workers in the reserves. It's being prepared for the White House by National Security Resources Board in cooperation with Defense and Labor Departments. Idea is to reconcile military and civilian demands.

CRITICAL EMPLOYEES: Present Defense Department policy is to defer a reservist only if he is "engaged in a critical occupation necessary to a highly essential activity and he will be deferred only until he can be satisfactorily replaced." Unlike the draft, dependency is not a factor in recalling a reservist, but consideration will be given to hardship cases. Deferments are limited to six months at a time.

WHAT IS ESSENTIAL: Commerce Department list of 72 essential industries and businesses includes metal mining. The definition includes establishments primarily engaged in mining, developing mines or exploring for metallic ores and includes, also, all ore dressing and beneficiating operations.

SELECTIVE SERVICE: Remember that the present draft is a peacetime law. How might it be changed to meet war conditions? Draft director Hershey has a big committee of Government officials studying what should be done. Chief draft limitations in the law are the 25-year age limit and exemption of World War II veterans.

WAGE CONTROLS: They won't come before next spring, if then. So labor unions will get another round of wage increases this winter. Upward wage trend continues.

FIFTH ROUND: CIO President Philip Murray will try to set the size of the fifth round wage boosts when he reopens the steel contracts Nov. 1, effective Jan. 1. He will shoot high. What the CIO is asking from rubber companies can gives you an idea: a 25c. raise across-the-board, 6c. more to correct area and plant differentials, plus a cost-of-living escalator.

QUICK OPENINGS: To hedge against rising living costs, unions will want short-term contracts or quick reopening wage clauses. Take the new meatpacking contracts. They are for two years. But wages can be negotiated every six months.

PENSIONS: They will be soft-pedaled. Most of the big unions have them now. Others will be glad to wait for pensions while they go after more money in the pay envelope.

SOCIAL SECURITY: Increase in old-age retirement benefits just passed by Congress contributes to the de-emphasis of pensions. However, with the Government assuming more of the cost of the $100 pensions negotiated in industry, unions will be seeking still higher pensions in the next few years. Stabilization of wage rates would accelerate this, just as wage controls during the last war stimulated the trend toward pension, welfare and other "fringe" benefits.

MORE FOR DEPENDENTS: A retiring worker will benefit from the more liberal Social Security law even though his $100 pension may remain the same. The new law gives as much as $70 a month more to his dependents.

STRIKES: Top officials of CIO's steel workers moved quickly to end the wildcat strike of five locals at Tennessee Coal, Iron & Railroad Co.'s ore mining and processing operations at Birmingham. These locals recently pulled out of Mine, Mill and Smelter Workers. They thought the company was too slow in reclassifying jobs. It's part of an over-all study U. S. Steel, parent company, undertook with the steel union at the end of the war. It has been completed in most other plants.

PICKETING: A new policy has come out of the National Labor Relations Board. It is this: neither the free speech section of the Taft-Hartley law nor the Constitution protect picketing (even though peaceful) if it is aimed at an unlawful objective, such as a closed shop, secondary boycott, featherbedding, or any other unfair labor practice. NLRB got into step with recent Supreme Court decisions. (Henry Shore and Juneau Spruce.)

LITERATURE: Nor can a union hide behind the right of free speech to distribute scurrilous literature on your property outside working hours. Reversing NLRB's view that it is an unfair labor practice to ban such distributions, a U. S. Court of Appeals says: The guarantee of free speech does not license slander. (Maryland Dry Dock.)

Open the books? Unions get an assist in their wage bargaining from this decision of NLRB: If an employer pleads inability to pay a wage increase, he must give the union financial data to back it up.

$67.5 million for non-metallic minerals; and $177.8 million for mining machinery and equipment.

COPPER-TARIFF—It begins to look as if the copper tariff suspension bill, now buried in a Senate committee, may stay that way. The senators are too harrassed by other matters, and will probably go home without acting on it. The Administration, however, may make some last minute move to force passage of the bill, once the controls and appropriation bills are out of the way.

ALUMINUM CAPACITY—Plans approved by the Munitions Board for selling potlines and rectifiers of the Burlington, N. J., and Riverbank, Calif., surplus aluminum production plants would increase primary U. S. production by 200 million pounds annually.

Plans are to sell the four remaining potlines (some were sold earlier) to Apex Smelting Co., Chicago, Ill.; Harvey Machine Co., Torrance, Calif.—thus bringing two new primary producers into the field to increase the aluminum supply.

Apex would set up production near Grand River dam, Okla.; Harvey, near Hungry Horse dam, Mont.; Reynolds at its plant at Jones Mill, Ark.; and Kaiser at a new plant in Ohio just across the river from New Haven, W. Va.

PREMIUM PRICES—A Senate amendment to the Defense Production Act of 1950 covering aid to mining duplicates S. 2105 as it passed the Senate. The way it looked as we went to press, the House-Senate conference committee would probably keep it, or something similar, in the bill.

MINING TAXES—Tax picture is confused since new defense needs made tax reductions impossible. Congress apparently will protect established depletion rates, but new concessions are doubtful. Accelerated amortization for essential industry is likely and some additions to carry-over privileges. Corporation levy will be hiked to 45% and excess-profits taxation looms after elections.

Defense Planning a Tangle of Conflicting Views, Interior Will Loom Large in Mineral Picture

ACTUALLY, the whole controls picture is in a state of confusion. On the one hand the various Government agencies have been jockeying for positions of increased power. On the other, they are frightened at the prospect of getting more of a job than they can handle.

The whole thing has been further complicated by a Congress anxious to get home for some much needed campaigning, but uneasy about extending Executive power. Senators and representatives alike have wanted to dump the defense program in the President's lap and let him make all the responsible, politically risky decisions. Then, every now and again, someone, seized by fear of giving the Executive Branch too much power, would throw in a crippling amendment, designed, he thought, to clarify matters, but in fact confusing the whole picture.

No matter what kind of controls bill may have passed by the time you read this, odds are strongly against there being any new agency, like a War Production Board, or OPA, being set up before elections. It's something Truman is dead set against both now and later. He wants the controls job of limited mobilization split up amongst the various established agencies.

The Department of Interior is probably going to play a big part in administering problems affecting the various metals and minerals produced in the U. S. unless the Senate viewpoint prevails that the entire allocations and price-control job should go to Commerce.

Most important to the mining industry is the fact that Interior will probably have the machinery and equipment allocations job for mines, smelters, refineries, and all other companies involved in delivering commercial metals or minerals to the first user. It will also be mining's claimant agency in seeing that the mining industry as a whole gets its share of scarce items.

Control Outlook

Just how soon controls will come and what controls was not clear as we went to press.

Rubber, steel, aluminum, zinc and copper seemed certain to go under allocations fairly soon. Probably, it will be some time before mining and processing machinery becomes in such short supply as to require rationing.

Actually, full defense production under mobilization as planned will not hit its stride for many months. That means controls will be needed only gradually.

Defense requirements were officially estimated to be 4 million tons of steel for fiscal 1951, 175,000 tons of copper and 100,000 tons of aluminum. These figures apparently exclude stockpile requirements and the following items as military aid to Europe: $33 million for steel, $23 million for copper, $6 million for zinc, $3 million for aluminum, $1 million for nickel, $400,000 for tungsten and $300,000 for chromite.

At this writing, at least, it looks as though the postwar mobilization planning done by National Security Resources Board, and other interested agencies, has come to naught.

Subsidies Planned

The Bureau of Mines will do more than just play a part in the operations of controls during mobilization.

It plans to spend some $80 million a year on exploration payments and purchase contracts to bring marginal mines into production of materials for the stockpile.

Plans now—assuming the money is forthcoming—call for $20 million a year to encourage exploration and $60 million in cost-of-production contracts.

Details of just how these plans would operate haven't been worked out finally. But, marginal mines would be brought into production by negotiating long term contracts with payments for each shipment of material to be based on the actual cost of production plus a certain operating profit. Government would pay the premium prices for the material, releasing whatever is necessary to industry at market price. Stockpile funds would absorb the loss.

Other plans call for setting up a 300,000 ton-a-year low-grade manganese ore concentrating plant at Artillery Peak, Ariz., where the Bureau of Mines already has a pilot plant in operation. Private industry will do the job under contract.

At the same time steel companies will get Federal money for research in the extraction of manganese from blast and open-hearth furnace slag, a potent source of this vital material.

Export Controls Will Be Reinstituted

ALONG WITH ALLOCATIONS of domestic supplies of critical materials for defense production you're going to see a revival of the World War II scheme of export control for conservation purposes.

That means that foreign buyers, when they come in for aluminum extrusions or ingots, or copper sheets, etc., are going to have to prove that their order is an essential part of the common western defense effort. Administrators of the Mutual Defense Assistance Program—arms aid—will have a big say in deciding just what exports are essential—what are not.

On top of this you're going to see a tightening up of security export controls—those that try to make sure no exported critical materials or equipment have an ultimate destination behind the Iron Curtain.

MARKETS—Trends and Prices (*Continued from page* 61)

United States Copper Statistics—1947, 1948 and 1949

(Bureau of Mines)

New copper produced—	1947	1948	1949
From domestic ores, as reported by:			
Mines	847,563	834,813	752,750
Ore produced:			
Copper ore (a)	87,864,898	84,729,043	76,032,531
Average yield of copper, percent	.90	.92	.91
Smelters	862,872	842,477	757,931
Refineries	909,213	860,022	695,015
From foreign ores, matte, etc., refinery reports	250,757	247,424	232,912
Total new refined, domestic and foreign	1,159,970	1,107,446	927,927
Secondary copper recovered from old scrap only	503,376	505,464	383,548
Imports (unmanufactured) (b)	413,890	507,449	552,704
Refined (b)	149,478	249,124	275,811
Exports of metallic copper (c)	196,999	207,022	195,990
Refined (ingots, bars, etc.)	147,642	142,598	137,827
Stocks at end of year	273,000	250,000	322,000
Refined copper	60,000	67,000	61,000
Blister and materials in solution	213,000	183,000	261,000
Withdrawals from total supply on domestic account:			
Total new copper	1,286,000	1,214,000	1,072,000
Price, average, cents per pound	(d) 20.9	21.7	19.7

(a) Includes old tailings. (b) Data include copper imported for immediate consumption plus material entering country under bond. (c) Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper. Exclusive also of "Other manufactures of copper," for which figures of quantity are not recorded. (d) Exclusive of bonus payments.

Official London Prices

The British Ministry of Supply continues to fix delivered prices of copper, lead and zinc for the United Kingdom. Quotations in effect as August ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	186	0	0
Fire refined, high conductivity	186	0	0
Fire refined, high grade	185	10	0
Fire refined, min. 99.7 percent	185	0	0
Fire refined, min. 99.2 percent	184	10	0
LEAD:			
Soft, foreign duty paid	112	0	0
Soft, Empire	112	0	0
English, refined	113	10	0
ZINC:			
Foreign (G.o.b.) duty paid	127	10	0
Domestic (G.o.b.) duty paid	127	10	0
Prime Western and debased	127	10	0
Refined and electrolytic	132	0	0
Minimum 99.99 percent	138	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(Aug. 31, 1950)

Aluminum, ingot, 99 plus percent, lb. (base price)	17½c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	27.78¢
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, delivered, lb.	$2.15
Calcium, 1 lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$1.80
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	48c.
Magnesium, 99.8 per cent, carloads, lb., producer's plant, Freeport, Texas	22½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$87.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$78.00
Selenium, 99.5 percent, lb.	$2.25
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$26.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
45% Cr_2O_3, no ratio	$17.30@$18.30
48% Cr_2O_3, 3 to 1 ratio	$35.00@$36.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.10
Mesabi bessemer	$7.95
Old Range non-bessemer	$7.95
Mesabi, non-bessemer	$7.70
Lead (Galena), 80 percent, Joplin, Mo., ton	$176.47
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, 74 @ 80c., c.i.f. U. S. ports, duty extra. Long-term contract prices nominal.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	84c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, duty paid	$29.00
Domestic, scheelite, 60 percent and upward	$32.00
Vanadium Ore, per lb. of contained VO_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 40 percent concentrate, Joplin, Mo. per ton	$99.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$1.95
Copper Sulphate, 100 lb.	$8.10

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be, 5 lb. or more of Be	$30.00
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	20.50c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$172.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo, contained	$1.13
Ferrosilicon, 50 percent, per lb. of contained Si	11.3c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.35
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1½ percent C, per lb. contracts	8.95c.
Spiegeleisen, per long ton, 19@21%	$65.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$497@$650
Spinning fibers	$323@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$88
	$27@$62
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$26.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.40
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$18.00@$18.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated bulk	$8.50@$9.50
North Carolina ceramic grade	$20.25@$22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50@$22.25
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$39.00
Acid 97% concentrate, bulk, ton	$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$32.00
Mica—Domestic f.o.b. mines, Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1¼ x 2 inch, 70 to 75c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $120 @ $130 per ton. Bulk sales, dry ground, $32.50@$40.00 per ton. Scrap, $30 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal

IRON AND STEEL

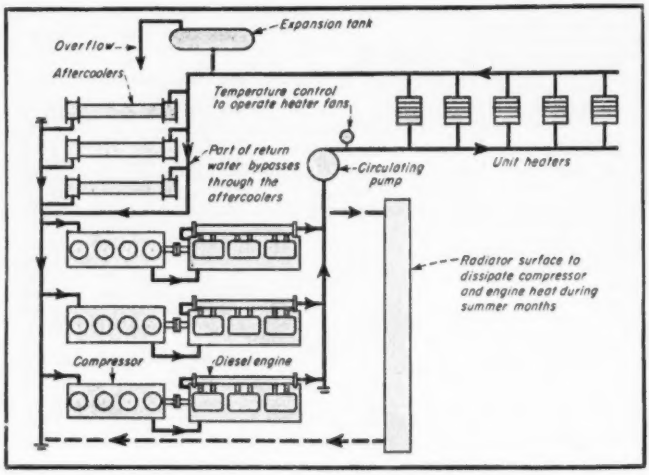
Pig iron, gross ton, basic, Valley furnaces	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$53.00
Structural shapes, 100 lb.	$2.40

OPERATING IDEAS

Waste Heat from Compressors Can Be Used to Advantage

Waste-heat from air compressors can be used to great advantage around the surface plant if proper measures are taken to remove the Btu.'s from the cooling water circulated through the compressing units. In the Schramm, Inc., plant, West Chester, Pa., three 315-cu.ft. per min. compressors driven by two diesel engines and a spark-ignition engine deliver 400,000 Btu. per hour into a system suitable for space heating or process heating elsewhere in the plant.

In this plant the air compressor cooling water is circulated through unit heaters mounted in various parts of the plant. The cooling water picks up Btu.'s from both the compressors and jackets of the engines as shown in the accompanying drawing. The heat recovered by this system is 1,250 Btu. per hr. per cu. ft. per min. of compressor capacity for air delivered at 100 lb. per sq. in.

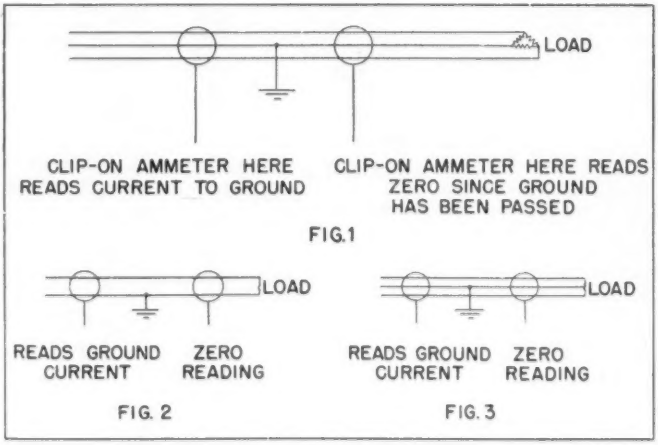


Similar installations could be used in mine plants to heat cold air going down the shaft in winter, to pre-heat boiler water, and to supply mine dry buildings with heat and hot water for showers. Drawing and information courtesy Compressed Air and Gas Institute, Cleveland 13, Ohio.

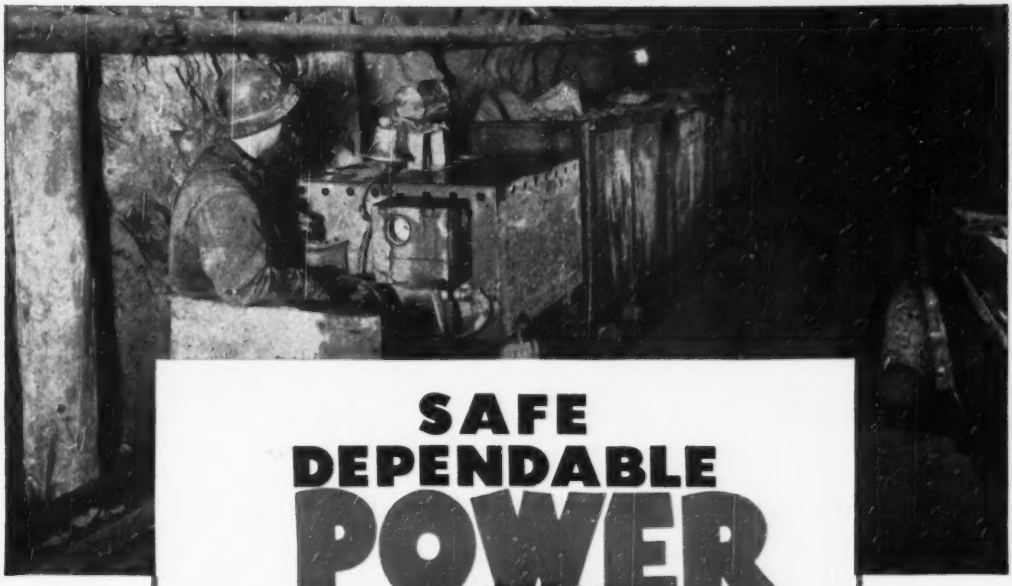
How to Locate Ground Faults Easily

When current flows to ground, a clip-on ammeter can be used readily in measuring this ground current to locate the fault, according to a practical item published in Westinghouse Maintenance News recently. If the circuit conductors are insulated and are small enough so that the clip-on ammeter core can be placed around all three conductors in a 3-phase motor circuit, the ammeter will read the resultant or ground current as shown in Fig. 1.

By moving the ammeter from place to place along the three conductors the ground can be readily located. Grounds on two and three-wire single-phase circuits can be located in a similar manner. By clipping both conductors of a two-wire circuit as shown in Fig. 2 or all three conductors in a three-wire circuit (Fig. 3) only the ground current will show up on the instrument. This current will disappear after the ground current is passed when going toward the load.



This method is better than measuring the individual phase currents, as it measures the abnormal current only. If the ground current happens to be small, it cannot be detected by measuring the individual phase currents. Furthermore, unbalanced ground currents not due to a ground will balance out to zero with this method.



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Put *full shift availability* into your battery-powered locomotives, trammers and shuttle cars. With Exide-Ironclad power, they'll handle as much load during the last hour as during the first. Also, Exide-Ironclad Batteries assure you:

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- low operating and maintenance costs.
- exceptionally long life—proved in more than 100,000 heavy-duty jobs.

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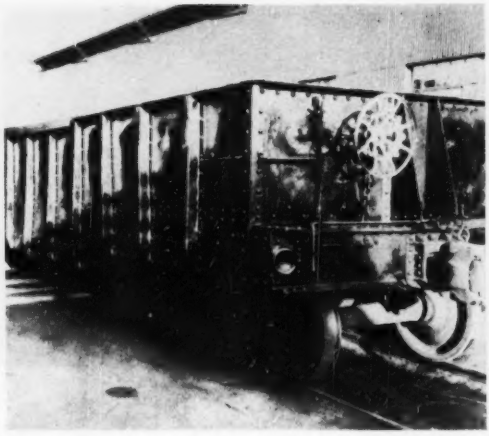

WHEN EQUIPMENT gets banged up like this . . . . . flame-heating may speed the repair.

Flame-Heating Equipment Repairs Damaged Cars

Railroad cars handling materials for steel mills suffer heavy damage as shown above. One company formerly spent four to five days per car to repair the damage by removing rivets, straightening bent plates, and reassembling. Then it adopted a method of heating damaged portions of the cars with Oxweld W-26 multi-flame blowpipes and cut down the repair time to two days and saved approximately $250 on each repair job.

The large-capacity blowpipe employed to heat the car bodies is also used for heavy-duty welding.

Photographs courtesy Linde Air Products Co.

Mine Developed Angle Bar Prevents Derailments

ERNEST JASPER points out angle bar that prevents tie slippage and consequent derailment at Willow Grove mine of Hanna Coal Co., Neffs, Ohio.

Derailments and consequent loss of loading time, resulting from slippage of ties at switch points, have been eliminated by an angle bar developed by Ernest Jasper, section foreman, Willow Grove mine, of the Hanna Coal Co., Neffs, Ohio.

All of the secondary track at this operation is 40-lb. rail, laid on armored clip ties or plain steel clip ties, and switches are prefabricated. Because of the slick bottom, considerable trouble had been experienced in keeping the No. 3 tie under the heel of the switch point and the closure rail. This resulted in numerous derailments and considerable lost loading time.

The tie had to be watched closely, and it cost considerable money to knock the tie under the switch point and closure rail joint. In the past, a plain 40-lb. strap had been used as a connector for the flexible joint where the switch points connected to the closure rail.

Mr. Jasper's answer to this problem was to take a regulation four-hole 40-lb. angle bar, cut it in two in the center, and then cut a $2\frac{1}{2}$-in. notch in the base of the two pieces of angle bar. As the holes in the angle bars are on 5-in. centers, the 2-in. notch in the base of the angle bar is offset. After making the first cut in the base of the angle bar, 1 in. from the center of the inby hole in the angle bar, he measured out 2 in., made the second cut, and then cut out the center. The notch sets down over the lug in the No. 3 tie and prevents it from slipping. The angle bar also will act as a connector at the flexible joint of the switch point and closure rail. Information and photograph published through courtesy of *Coal Age*.

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RYERSON STEEL

PERSONAL NEWS

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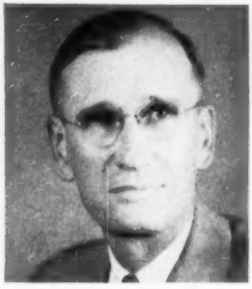


GROVER J. HOLT

THE REMARKABLE THING about Grover Holt is that he has had so much to do with so many different aspects of mineral industry progress. It is a passion with him to make things work, whether it is a belt conveyor underground or a heavy-density separator in a mill. He has made more things work than most of us ever get our hands on.

For instance, Grover Holt worked on the original pilot plant in the Iron Country that tried out the "Differential Density" process with galena as the medium. Later he helped develop use of ferrosilicon in the first iron ore pilot plant to use that medium. Then he carried his work right on into successful full-scale plant operation.

He has been so closely identified with iron ore beneficiation that his name invariably turns up among the first few in any listing of men who have done most to advance iron ore metallurgy. Yet Grover Holt has probably spent more time making conveyor belt and truck haulage systems work than he has in heavy density plants.

Born in Northwood, N.D., Grover Holt graduated from the University of North Dakota at Grand Forks. He barely got in a year's fellowship at the University of Utah in ore dressing, when World War I took him off to France as a lieutenant with the Army Engineers.

After the war, he worked with Bunker Hill in the mine and the smelter for a couple of years, then went with Oliver Iron Mining Co. in 1921. He has never been very far away from the Iron Ranges since.

Grover went with Butler Brothers in 1927, and became assistant to the vice president in 1930. He stayed with Butler until 1942, working on any number of things; for example, truck haulage as against belt conveyors in pits; belt conveyors vs. shaker conveyors underground; new and improved methods of concentrating the "intermediate" iron ores.

Then in 1942, Grover went to Ishpeming, Mich., with Cleveland-Cliffs Iron Co. as chief engineer for their Minnesota and Michigan mines. He carried on his work with conveyor belt installations, both in the Mesabi pits and the Michigan underground mines. He did much to develop the first conveyor used to stockpile underground ore on the Marquette Range.

During this period, too, he helped develop a block caving method for Cleveland - Cliffs' Athens mine, where, under the direction of C. W. Allen, then manager of Michigan mines for Cleveland-Cliffs, substantial cost savings were made. (See *E&MJ*, Nov., 1949, p. 96.)

In most recent years, he has spent much time on investigation of methods for concentrating and using the low-grade "iron formation" of the Marquette Range. Cleveland-Cliffs, as a result, is in the forefront of those prepared to use these ores when necessary.

Realizing that exchange of information is essential to intelligent growth, both for an individual and for an industry, Grover has always been willing to share his experience with others. He has written articles for *E&MJ* and other publications. His earnest discussions of operating problems, punctuated by a waving cigar, have enlivened many an otherwise sleepy session at an Institute meeting.

Grover takes an active part in AIME affairs, and he is the 1950 chairman of the Minerals Beneficiation Division. He is also vice chairman of the Minnesota local section.

He was recently appointed manager of the Minnesota mines for Cleveland-Cliffs, and from now on his headquarters will be in Hibbing. At least, his office will be there, but you'll probably find Grover out on the Range or in some plant, doing what he enjoys most, which is the best he can to make the job go more smoothly and at a lower cost.

Benno Elkan has retired as director and chairman of International Minerals & Metals Corp. He will continue as president of National Zinc Co.

Dr. Francis A. Thomson, president of Montana School of Mines, was the guest of honor at a testimonial luncheon held July 31 at Butte as part of the annual meeting of the Montana Mining Association. Dr. Thomson was lauded for his contributions to mining, education and the well-being of Montana.

C. J. Stakel, general manager of Cleveland-Cliffs Iron Co.'s iron ore operations, retired Aug. 1. He will continue to serve in a consulting capacity.

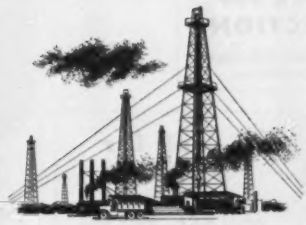
Roger W. Straus, president, **R. F. Goodwin,** vice president, and **Oscar S. Straus,** treasurer, American Smelting & Refining Co., recently spent ten days in Buchans, Newfoundland, inspecting the Buchans mining operations of the company.

A. H. WOHLRAB, vice president and general manager of the Calumet Division, Calumet & Hecla Consolidated Copper Co., was retired Aug. 1. He will be retained as consultant in connection with the company's zinc operations at Shullsburg, Wis.

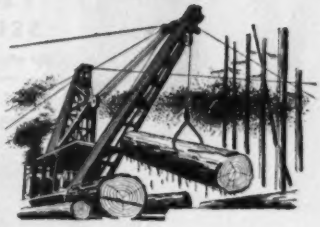
Robert G. Kenly, formerly manager of the metal division, New Jersey Zinc Sales Co., has been made assistant general sales manager. **Frederick W. Jones,** who has been assistant to the general sales manager and manager of the export division has assumed the title and duties of manager of the pigment division. **Ernest H. Klein,** assistant manager of the metal division, is now manager of that division.

Rodolf Eichelter, general superintendent of the Austrian Alpine Montan, Eisenerz, Austria, was on the Mesabi range in July to study mining methods and ore treatment practices. His company conducts open-pit mining, as well as underground, on a mountain of iron carbonate ore.

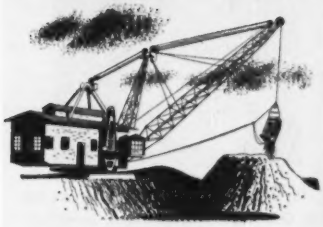
For better service use the right rope



For rotary drilling, *PRE*formed, Internally Lubricated wire line designed to wind smoothly on drums and to withstand abrasion from running through blocks.



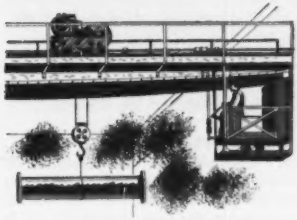
For logging operations, tough flexible ropes for tractor arch lines, chokers, skidders and loading.



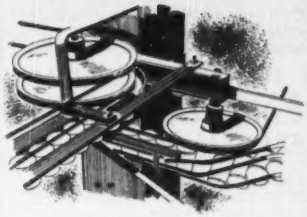
For shovels and draglines, ropes for different sizes and types of equipment designed to give best service for your particular needs.

The right rope for each job is available from

For shaft mining, shallow or deep, internally lubricated ropes to meet all load and speed requirements.



For cranes and hoists, small or large, *PRE*formed Internally Lubricated wire ropes of the correct size and flexibility for each use.



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Albert Boring McElhoe was recently appointed instructor of geology and minerology at Reedley College, Calif. He was graduated from the University of California at Santa Barbara in 1947.

Joseph J. Lembo, Jr., of Philadelphia, has been elected president of Minas de Ouro Saude, a gold mining project located in Bahia, Brazil. The project, which dates back to 1945, is expected to have its first mill in operation by September 15.

C. W. ALLEN, manager of Cleveland-Cliffs Iron Ore Co.'s Michigan mine operations, has been made general manager of the company's iron ore operations.

O. A. Rockwell, assistant general manager, Calumet Division of Calumet & Hecla Consolidated Copper Co., has been appointed general manager of the division to succeed **A. H. Wohlrab,** retired.

John Howes, Cooley, has been appointed manager of the engineering office of M. A. Hanna Co. for its Cooley district mines.

Albert E. Thiele, a director and formerly vice president and treasurer of Pacific Tin Consolidated Corp., has been elected chairman of the board. He succeeds the late **George W. Coffey. Norman Cleaveland,** formerly manager of Malay operations, has been elected a director and president, and **Franklin S. Miller,** assistant manager of the Malay operations, has been appointed a vice president, with headquarters in New York.

Samuel Naismith, ore evaluation engineer with Oliver Iron Mining Co., has been appointed assistant supervisor of ore movements, according to an announcement by **J. E. Machamer,** vice president in charge of operations. **E. R. Bechtel** is supervisor of ore movements for the Oliver company.

Olaf T. Berge, mining engineer at Pickands Mather & Co.'s Mahoning mine has been transferred to the district office in Hibbing. **Clyde D. Keith, Jr.,** mining engineer at the Biwabik mine, has been moved to the Mahoning to replace Mr. Berge.

Howard M. Graff, assistant to **A. J. Cayia,** Manastique, manager of iron mines and quarries for Inland Steel, has assumed his new duties as assistant general superintendent of the Inland Steel Company's iron mining operations, under **R. D. Satterley,** general superintendent, at Ishpeming.

R. C. Cole, formerly assistant manager of the American Smelting & Refining Co. at Salt Lake City, has been transferred to the ore buying department in the company's main office at New York.

Arthur J. Blair, chief geologist, Tennessee Coal, Iron & Railroad Co., has retired. He has opened an office as consulting and mining geologist at 620 First National Bldg., Birmingham, Ala.

Charles V. Harris, formerly located in San Jose, Costa Rica, is now mill superintendent with Blue Star Mines, Ltd., in Big Pine, Inyo County, Calif.

Charles Grimes recently was appointed a safety inspector for the Montana Industrial Accident Board at Helena. He is a graduate of the Montana School of Mines.

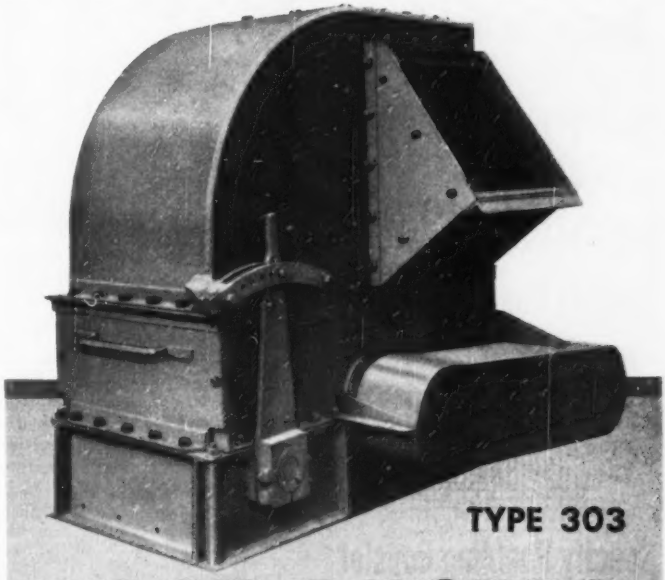
W. A. STERLING, who has been serving as manager of Cleveland-Cliffs Iron Co.'s Mesabi range properties, was recently elected a vice president and will direct all mining operations of the company. He has been with Cleveland-Cliffs since 1919.

Gordon I. Gould & Co., mining and metallurgical engineers, has been organized in San Francisco to conduct a general mining business. **Gordon I. Gould,** head of the new company, is president of the New Idria Quicksilver Mining Co. and the New Idria Honduras Mining Co. He was formerly associated with H. W. Gould & Co.

Richard E. Thompson, recently graduated mining engineer, is now employed by M. A. Hanna Co. at its Hibbing, Minn., headquarters office.

E. C. Norris, Jr., of Republic Steel Co.'s Cleveland office has been transferred to Duluth where he will be director of safety for Republic's Lake Superior mines. He succeeds **John H. Mulcahy,** who is now at the company's plants at Youngstown, Ohio.

JEFFREY



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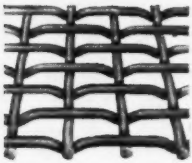

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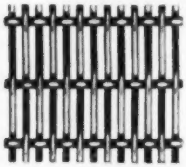

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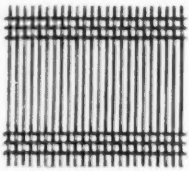

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A CENTURY OF CONFIDENCE

PRESENTATION OF JOSEPH A. HOLMES SAFETY AWARD was made recently by Allen D. Look, engineer of the U. S. Bureau of Mines, Phoenix, Ariz., to the men of the Chino Mines Division of Kennecott Copper Corp., Santa Rita, N. M. Two citations were made, covering different periods of time in the handling of explosives in metal mining operations. Shown, left to right, front row: Mr. Look, George Anderson, Horace Moses, William F. Sullivan, Severo Cordova, Cipriano Montoya, Plutarco Peraza and K.V.N. Harris. Second row: D. Bruce Leake, A. P. Morris, F. C. Green, W. E. Herkenhoff, William Wallace, T. A. Gennett, Melvin Reece, William Humble and G. J. Ballmer, general superintendent of mines. Back row: T. H. Schroter, Russell Wilson, George Westover, and William H. Goodrich, general manager of Chino Mines, who accepted the award.

Ben D. Roberts has been transferred from the ore purchasing department in the New York office of American Smelting & Refining Co. to the position of assistant manager, Southwestern Dept. His headquarters will be in El Paso, Tex.

J. D. MacKenzie, vice president, **R. P. Reese, Jr.**, assistant to the president, and **R. L. Jourdan**, manager of the ore purchasing department, American Smelting & Refining Co., have recently returned from a business trip to the western smelters of the company. They also attended the Metal Mining Convention of the American Mining Congress, held in Salt Lake City in August.

Harry J. Wolf, consulting engineer, has been active during the past several months in a consulting capacity with respect to the development of mineral properties in Colorado. He has also recently investigated mineral deposits in North Carolina.

William W. Tamplin spent July and August in the Philippines, as mining consultant to the U. S. Economic Survey Mission.

Dr. Robert H. Steiner has been appointed research coordinator of the Atlas Mineral Products Co., Mertztown, Pa., according to an announcement by **George L. Wirtz**, president.

William B. Miller, mining geologist, and **John S. Garman**, mining and industrial engineer, representing Clyde H. Shoemaker Associates, New York, consulting mineral engineers, have recently completed the examination of industrial mineral deposits in Ecuador.

Admiral Jonas H. Ingram, U. S. Navy, retired, has been elected vice president of Reynolds Metals Co. in charge of executive sales. A native of Indiana, he served 45 years in the Navy following graduation from the U. S. Naval Academy. He became associated with Reynolds in December, 1949.

ISHAN RUHI BERENT has resigned as director of the Mining Research & Exploration Institute of Turkey and has organized a consulting engineering firm with offices at Sokak No. 11, Istanbul, and Ataturk Buluari Bolu Apt., Ankara.

C. R. Ranney, mining engineer and geologist, has been appointed operating engineer and assistant manager of the Nancy Lee Mines, Inc., according to **Frank Eichelberger**, general manager.

Robert James Armstrong, operating superintendent of the Montana Phosphate Products Co., near Garrison, Powell County, Mont., has been made assistant to the general manager of mines of the Consolidated Mining & Smelting Co. of Canada, Ltd., at Trail, B. C. He is succeeded at Garrison by **Fred Burnett**, now an operating official of Consolidated at Trail.

R. H. Ogburn, assistant general manager at the Fairbanks, Alaska, operations of U. S. Smelting, Refining & Mining Co., retired Aug. 1. He had been with the company for 25 years, acting as surveyor, superintendent of thawing and stripping, and assistant manager. In 1946 he was made assistant general manager. **J. O. Crawford**, who has been with the company since 1929 will be manager of the Fairbanks operations.

Dr. William S. Wilson, a graduate of Brown University, is the new acting director of the Geophysical Institute at the University of Alaska.

Dr. William C. Aitkenhead, formerly with the research department of the Colorado School of Mines at Golden, has been made chief of the mining experiment station of the industrial research division at Washington State College, at Pullman.

OBITUARIES

Prof. V. V. Clark, 77, died July 31 in Los Angeles, Calif. He was a noted mining engineer and former head of the department of mining engineering at the University of the Philippines.

Dr. Warren DuPre Smith, 70, nationally known geologist and author, and for 33 years head of the department of geology at the University of Oregon, died July 17 at Eugene, Ore. In early life he was a geologist for the U. S. Bureau of Mines in the Philippines.

George W. Coffey, president and chairman of the board of Pacific Tin Consolidated Corp., died early in July in New York City. A native of Nevada City, Calif., Mr. Coffey received a B.S. in mining engineering from the University of California in 1917. He was associated with Miami Copper Co. from 1921 to 1924, and later worked on mine examinations in Bolivia with Yeatman & Berry, New York consulting engineers. He joined the Yukon Gold Co., now the Pacific Tin Consolidated Corp. in 1926 and served as resident manager in the Federated Malay States for several years. In 1939 he was named vice president of the company and became chairman and president in 1945.

Milton Hoyt, mining engineer, died July 16 at his home in El Paso, Texas. He was a graduate of Drake University and did post graduate work at the Colorado School of Mines. Mr. Hoyt had been employed in engineering capacities in the United States, Mexico and South America since 1907. He was 66.

Col. James Wainwright Flanagan, 77, internationally known mining engineer, died July 24 in Houston, Texas. He was closely identified with several large engineering projects in Central and South America.

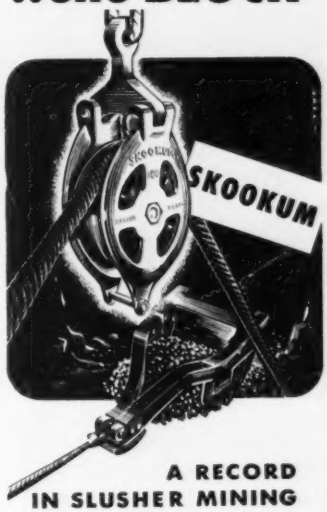
C. O. Dunlop, president of Silver Dollar Mining Co., died Aug. 10 in Spokane. A native of Minnesota, he went west to Lewiston in 1919 and later moved to Wallace, Idaho, where he became associated with Stratton Silver Summit Mining Co., which in 1934 changed its name to Silver Dollar Mining Co. He was also president of Mines Management, Inc., and a former president of the Northwest Mining Association. Mr. Dunlop was 60 years old.

Charles Moore, who aided and pioneered in the mining and milling operations at Park City, Utah, at the turn of the century, died in Sacramento, Calif., July 29. He was 83. He was one of the founders of the New Park Mining Co., consolidated from a number of claims he had helped develop.

Harold S. Arnold, technical assistant to the president of International Nickel Co., Inc., died suddenly Aug. 7. He joined the company in 1914 at the physical testing laboratory at Bayonne, N. J. Later he was made assistant to Dr. John Thompson, now president, when he was superintendent of the operating and technical department. When Dr. Thompson was transferred to the New York executive offices as metallurgical engineer, Mr. Arnold was also transferred as his assistant. He served as assistant to Dr. Thompson when he became vice president in 1935, and was made technical assistant to the president in 1949, at which time Dr. Thompson was made president. Prior to joining International Nickel, Mr. Arnold was employed by U. S. Smelting, Refining & Mining Co. He later worked as an engineer in a private gold mining company in southern Mexico, and also served on the engineering staff of the National Lead Co.

Edmond C. van Diest, mining, civil and consulting engineer, died Aug. 1 at his home in Colorado Springs. He would have been 85 years old on Aug. 13. He came to Colorado Springs in 1903, having arrived in this country in 1871 from the Dutch East Indies, where he was born. He was a graduate of the Colorado School of Mines in 1886 and several years ago was awarded an honorary degree of doctor of engineering by the school. In May, 1949, Mr. van Diest was awarded a distinguished medal by the school of which he was the oldest living graduate. He was president of the General Service Corp., the Plomo Mining Co., the Rito Seco Gold Mines Co., Metals Exploration Co. and numerous other power and service companies. He was active in civic affairs.

15 Years
..one BLOCK



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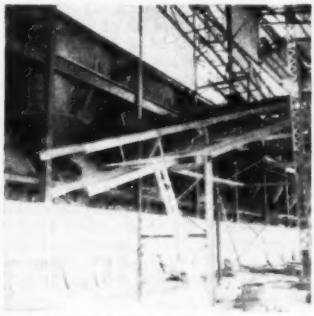
NEW 1,000-TON CARLTON MILL in Cripple Creek district of Colorado, now nearing completion, will receive custom ore from this famous gold district.

MAN ELEVATORS will be installed in openings in concrete floors.

MATERIALS-HANDLING units will move from floor to floor on ramps.

NEW HOLLAND CRUSHER just installed. A 50-ton bin is shown in rear.



36-IN. CONVEYOR will carry output of crusher to sampling section of mill.

New Carlton Mill Nears Completion

CONSTRUCTION OF the new Carlton mill at Cripple Creek, Colorado, by the Golden Cycle Corp. is entering the final stages. Outside walls and roof are virtually completed, and concrete flooring is well along. Considerable equipment has been installed including conveyor belt supports, ore bins, tanks, and a crusher.

Capacity of the mill will be 1,000 tons, with ample room for enlargement if necessary. It has been designed to serve as a modern custom mill for the district. Shipments received in the multiple receiving bins are kept as separate units as they go through weighing, storing, conveying, crushing, and sampling circuits. Shippers will be able to observe their ore in process through a special seller's gallery.

The flowsheet is the result of considerable research on telluride ores plus the backlog of experience which the company has acquired in milling some 15 million tons at Colorado Springs. The new mill will incorporate modern units for grinding, flotation, roasting, Cottrell dust precipitation, gravity concentration, high and low-grade cyanidation, zinc precipitation and carbon adsorption. Automatic weighing devices and recording pyrometers will facilitate process control in the various roasting and concentration sections of the plant.

The mill is virtually of fireproof construction with a steel frame, pumice-block walls and corrugated metal roofing. Power driven lift trucks will be used to handle materials during mill operation, and special ramps have been built to permit these units to travel from one floor to another. Man elevators will be provided in some parts of the mill. Full headroom is provided in all parts of the mill so that workers will not have to perform jobs in cramped positions. All ore bins are located inside the building to prevent freezing during storage.

Visitors in the area will be surprised to see the skill with which present working crews rig steel, pour concrete and lay bricks, and handle the numerous welding jobs—especially when they learn that the workmen are former gold miners and leasers in the area who are awaiting completion of the mill to go back to their former occupations. The company adopted the policy of hiring these miners and making construction workers out of them to keep them occupied during the temporary lull in mining in the district, and the experiment has proved very successful.

Operations are under the direction of Max W. Bowen, vice president and general manager of Golden Cycle, and Harold S. Worcester, assistant general manager. The O. W. Walvoord Co. of Denver is contractor for design and construction.

IN MINING

IN THE UNITED STATES

- Stripping Starts at Consolidated Coppermines — P. 126
- $5 Million Phosphate Plant for Montana — P. 125
- Montana Mining Meeting — P. 130

ALASKA

★**J. H. Scott Co.'s tungsten and lead mine** just across the Alaskan border, is using the Catalyst, a 70-ft. boat used by the University of Washington's oceanography department for research work before the war, to carry its ore from Hyder to Tacoma, Wash. The boat's capacity is 60 tons.

★Ted O. Banks, ethmo-botanist of the University of Michigan, John McClain, geologist of Trinity College, and H. A. Miller, botanist from the University of Hawaii, went to Adak and other Aleutian villages this summer **to gather radioactive carbon material** as part of a research project into radioactive materials and the development of atomic energy for peacetime scientific use. This was the first such undertaking in Alaska.

★According to the U. S. Bureau of Mines, **gold production was 4% greater** in May than in April in Alaska. Copper production was also up 2% in May.

★Permanente Cement Co. on July 14, **opened its new distribution plant** constructed by Morrison Knudson Co. at Anchorage, to serve those interested in Alaska Highway and railway areas.

★**Gold production which amounted to 229,416 fine oz.** in 1949 was 8% below 1948 figures but still ranked first in value, according to the Juneau office of the Bureau of Mines. Mineral output rose in value from $13,026,000 in 1948 to $15,299,000 in 1949. Coal ranked second to gold in value of output. The only shipments of antimony reported were from the Stampede mine in the Kantishna area. Seventy-four tons of concentrates contained 87,780 lb. of antimony. Coal production, 455,000 short tons, according to preliminary figures, was up 12% over 1948. Placer operations at DeCoursey Mountain mine yielded 100 flasks of mercury in 1949. Platinum production from Goodnews Bay Mining Co. was higher than in 1948. Tin from the Port Clarence district in the Seward Peninsula area amounted to 21 long tons shipped by the U. S. Tin Corp. and 29 long tons by the Northern Tin Co. Lead was 1/6 of the 1948 production, silver ½, copper ¼, and zinc 1/10.

★**Discovery claim on Pedro Creek is being mined** by Nick Kupof and Alex Tavitoff with a bulldozer and tractor, and a hydraulic plant.

★Deputy Marshal Francis X. Wirth, of Tanama, reported in Fairbanks recently that Glen Gregory and Earl Thronsen, who fly from Tanana to the Kotzebue area, found some **"good sized" gold nuggets** under moss in the frozen ground. The exact location has not been revealed.

★John H. Dryer of Seward has a crew of three doing **development work at the East Point mine**, on Falls Creek, which had been idle for several years. Supplies were dropped by parachute to the property.

★Howard Hayes is actively engaged this season in **recovery of mine tailings** near Juneau and also at the old Chichagof mine at Chichagof.

★Hirst Chichagof gold mine, on Kimsham Cove, north of Sitka and on the west coast of Chicahagof Island, **will resume full production** this winter. It is reported to be the first hard rock mine to resume production since the 1943 order of suspension by the WPB. Production was at a 50-ton daily rate by amalgamation and flotation process. According to Paul M. Sorenson, the mine paid $1 million in one 5-yr. period. Mr. Sorenson stated, "The dividends will not be as much as in the past, but the directors and I agree that we should be able to operate at a reasonable profit." The mine is said to be the second largest hard rock gold producer in the Territory.

ARIZONA

★Helicopter service from an asbestos mine site within the Grand Canyon in northern Arizona is being operated by Arizona Helicopter Service. The mine is patented land, staked out in 1903, and is the only place an aircraft is authorized to land within the park grounds. Now used as a sightseeing medium, it is planned to carry ore out of the canyon within a year.

★Dr. Robert J. Wright, Atomic Energy Commission geologist from New York, is **checking uranium mine sites** in Northwestern Arizona.

★**A study of danger to men engaged in uranium mining** and an analysis of required precautions is being conducted by the U. S. Public Health Service in Arizona. There are five actively producing uranium mines in Arizona, all in remote areas of the Navajo Indian Reservation.

★**The Cooper Shapely fluorspar mine in the Whetstone Mountains has been sold** to the Pepperdine Foundation, Los Angeles, and Joffre Marcei and Henry Boherman. Jack Ross, Benson, has been named superintendent. Frank Wicks, Los Angeles, is general manager and engineer.

★**Leadville Mining Co.** and properties of the Great Western Mines at Courtland in Cochise County have been purchased by Edward J. Oakley, Junction City, Kan.

CALIFORNIA

★Higher prices and the improved metal outlook are encouraging **higher production of lead, silver and zinc in Inyo County.** Anaconda Copper is milling 125 tons of lead-silver-zinc ore at its Darwin mine, and is expanding operations at its Shoshone property near Tecopa. Over 100 tons of lead-silver ore is being shipped monthly from the Santa Rosa mine at Keeler, and several other properties are active in the vicinity.

★**Best Mines, Inc., is undertaking deep development** of the Brush Creek gold mine near Downieville. The company is sinking a 400-ft. winze

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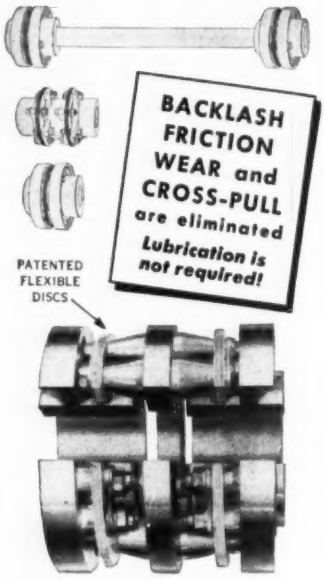

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California *(continued)*

from the main tunnel, and plans to drive a lower 2,200-ft. tunnel. The Oxford mill, with a capacity of 100 tons of ore daily, processes the ore.

★**Mount Diablo Exploration Co. is working the Skyrocket mine at Hodson,** and some high-grade ore is being developed on the 200-ft. level. The orebody, which extends along the vein for 90 ft., was discovered by crosscutting from the 205-ft. inclined shaft. C. B. Wood of Copperopolis is mine superintendent.

★**A large deposit of gypsum,** located in Quatal Canyon near Bakersfield, is providing daily shipments of 50 tons. Monolith Portland Cement Co., working the deposit, is considering building a plant at the site if a highway is built providing easier access to market.

★**Mobilization of tungten mines** in the Fresno district to meet wartime requirement is being studied by the American Tungsten Association, H. A. Savage, Fresno attorney and president of the Association, stated recently. Fifteen mines are being studied by the Association to determine the potential capacity of each. But the market price for tungsten of $23.50 to $24 for a 20-lb. unit is a deterrent to present production. World War II price was $30 a unit when the tungsten core shell was much used in combating German tanks.

COLORADO

★**Receipts of gold reported** by the Denver mint totaled 331,796 oz. for the first six months of 1950 as compared with 239,587 oz. for the same period in 1949. Silver receipts for the first six months of 1950 were 95,527 oz. compared with 61,709 oz. last year. The number of deposits rose from 112 to 149.

★**Harvey Chapman, State mine inspector** for Clear Creek County, reported activity at the following mines: Front Range, Dixie and Draper-Rainbow, Endeavor, Lamartine, Turner, Valentine, Franklin, Silver Age, Diamond Joe, Lone Star Floyd Hill, Nabob, Three Sisters, Bellevue, Hudson, Smuggler, Gold Mines Consolidated, Grizzly, Gold Dirt and Mint operations.

★**Pitchblende has been rediscovered** in the Bellevue Hudson mine near Lawson and Empire. Schweiterman Brothers have been reconditioning the property and ran into pitchblende while cleaning out a crosscut. An AEC man is reported to be on the job.

★**Camp Bird Mine, Ltd.** reported a profit of $43,600 in 1949, as compared with a loss of $5,500 in 1948. The mine is now being developed by lessees under royalty terms. Plans call for the expenditure of $200,000 in enlarging the scale of operations. An extension of the lease until Dec. 31, 1955, includes a provision that milling capacity be increased from 135 tons per day to 200 tons by Nov. 1.

★**The Alma placer** is to be operated by Platte River Placer, Inc., a Colorado corporation. Testing of the ground was commenced last October and finished in June, and in that period 32 holes were drilled. A semi-crawler-mounted dry placer machine and portable sluicing plant having a capacity of about 200 cu. yd. per hr. is now being constructed for delivery this month. Actual digging to supply the washing plant will be done by power shovel.

★Year-around operation of the **Pride of the West mill** near Silverton at Howardsville has been assured with recent grouping of several mine properties to provide a year around supply of ore. The mill recently began treating Great Eastern mine ore. The mine can be operated in the summer and fall only. Ore from other mines at lower elevations will supply the mill during the winter months.

★E. A. Abadie, manager of the **Treasure Mountain Gold Mining Co.'s** property near Silverton, reports that they have encountered a 7-ft. vein of ore of good quality. Eventually the company will start its mill.

★**Champion Mines Co.** of Cripple Creek reports samples from the crosscut on the 1,151-ft. level of the Forest Queen mine under lease have been running from .24 to 3.80 oz of gold per ton, according to Francis Gunn, superintendent of the properties. Last year the shaft was sunk 200 ft. The ore is on W.P.H. claim which the company has also leased from the United Gold Mines Co.

★**Vitro Manufacturing Co.,** of Pittsburgh, is making plans leading toward an early entrance into the Colorado Plateau as refiners of uranium bearing ores and raw materials. For this purpose the company has acquired an industrial site in Grand Junction and recently opened an office there. M. G. McGrath, metallurgical engineer, formerly with the Grand Junction office of the Atomic Energy Commission, joined Vitro on June 1 and now is manager of Western operations with headquarters at Grand Junction.

IDAHO

★**Coeur d'Alene Mines Corp. has opened up a new vein** on the 2,800-ft. level 13 ft. wide which averages 21 oz. silver and 1% copper per ton. Narrow high-grade streaks assay up to 1,000 oz. silver per ton. The vein dips southerly at an angle of 85 deg., and where opened on the 2,800-ft. level, it lies in American Silver ground. On this vein the two companies are operating on a 50-50 pro-

duction agreement. Coeur d'Alene Mines is drifting easterly on the vein.

★**The Livingston silver-lead mine** in south-central Idaho is under lease to Charles Hilsen, of Flint, Mich., and Dave Bell, who are building a $45,000 milling plant near Custer, Idaho, to treat the Livingston ore.

★The U. S. Government will start construction of a **model atomic-powered submarine engine** at Arco, Idaho, site of AEC's reactor test plant. Experimental work will involve an expenditure of $25 million, and is under the direction of the Westinghouse Electric Corp.

★**Polaris-Silver Summit is milling** 175 tons daily. Concentrates average 700 oz. silver and 19% copper.

★During the first six months of 1950 **Sunshine Mining Co.** averaged 5,009 tons greater monthly production than in 1949. Output for the first half of 1950 totaled 136,528 tons as compared with 156,027 for all of 1949.

★**War Eagle gold mine** near Burgdorf, which was closed by L-208 during World War II, is to be re-opened according to E. Walter Peterson, president and manager.

★**Golconda Lead Mines Co.** has completed its winze development to 140 ft. below the 1,000 tunnel level, all of which has been in good silver-lead ore. June shipments netted the company $15,753.

★**Silver Syndicate** production has averaged 4,000 tons of silver-lead ore per month for the first six months of 1950. The orebody has been proven for a length of 580 ft. Production has been confined to development work and stopes on the 3,700 and 3,500-ft. levels.

★**Bunker Hill & Sullivan** company is working on the development of its second block of low-grade ore to be mined in the old upper workings under the block-caving system recently developed under the direction of Charles Schwab, mining engineer. The first block of ground is ready for production whenever the price of lead warrants it.

★**Highland-Surprise mine**, on Pine Creek, has recently increased its production from 50 to 75 tons per day and is opening the Surprise vein on the 1,450-ft. level. The company is also prospecting the Nevada-Stewart property on the 700-ft level. Robert D. O'Brien is the new manager of Highland-Surprise.

★**Triumph Mining Co.**, operating the old North Star mine in Blaine County, is now building a new 200-ton mill which will employ flotation and the Heavy-Media Separation process. Western Machinery Co. has the contract for construction and installation according to A. H. Shoemaker, manager. The mine employs 120 men.

(Continued on page 122)

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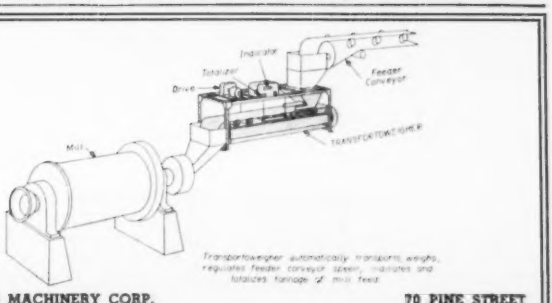

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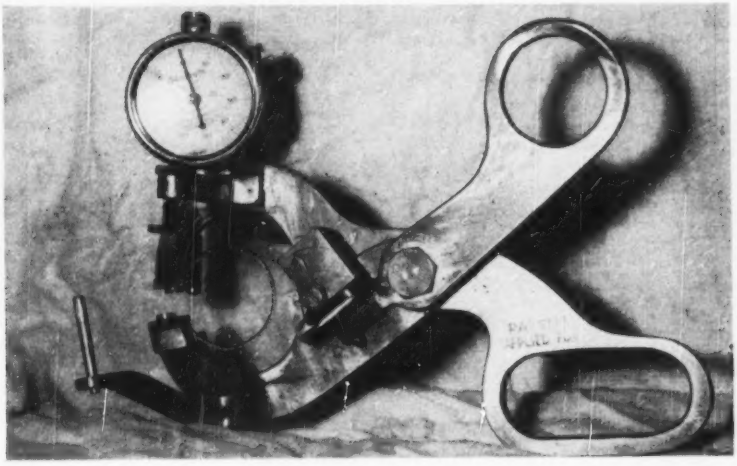


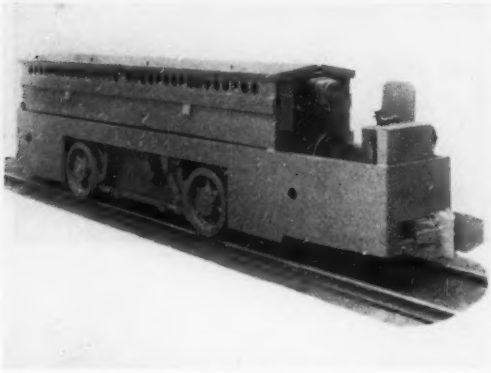
Wear-O-Meter Detects Invisible Wear in Hoisting Rope

IN TESTING HOISTING ROPE, you have to be careful not to miss sections of the rope where there may be a substantial decrease in diameter without any external evidence of wear or corrosion. To detect these danger spots, H. K. MacKenzie, master mechanic at the Pioneer Mine (British Columbia), has developed the Wear-O-Meter.

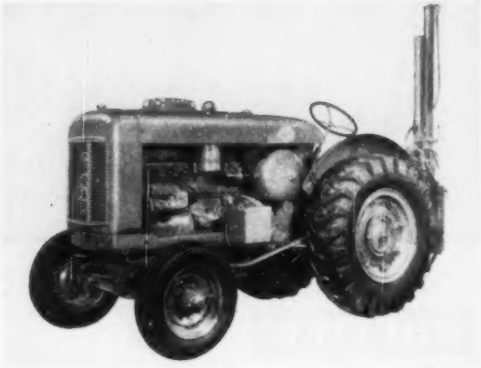
The instrument is so designed that an accurate measurement is taken by clamping the device over the rope and exerting pressure on the scissor-like handles. Variations in diameter are read directly on a micrometer dial and the tension applied for each separate reading is kept constant by a small tension indicator. The Wear-O-Meter can accurately measure the circumference of ropes from ¾ to 1⅛ in. in diameter to the nearest thousandth of an inch.

Mr. MacKenzie has applied for patent rights, but the instrument is not yet on the market. For more information circle **No. 1** on the reply card opposite page 118 and mail to E&MJ. (No stamp is required.)

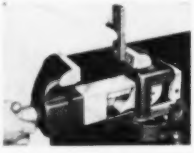
We are indebted to H. C. Hughes, Chief Inspector of Mines, British Columbia, for calling our attention to this interesting new device.



BATTERY LOCOMOTIVE weighs 6 tons, operates on 24-in. track but is only 32 in. wide. Battery box is easily removable. Employs two 9½-hp. motors, automatic couplers. Atlas Car & Mfg. Co., Cleveland, Ohio. (2)

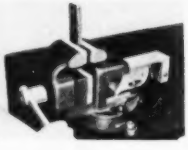


PNEUMAJACK has rock drill mounted on piston rod of pneumatic cylinder at rear of tractor. Drill has 46-in. movement, making 24-in. changes easy. Unit is made by Schramm, Inc., West Chester, Pa. (3)

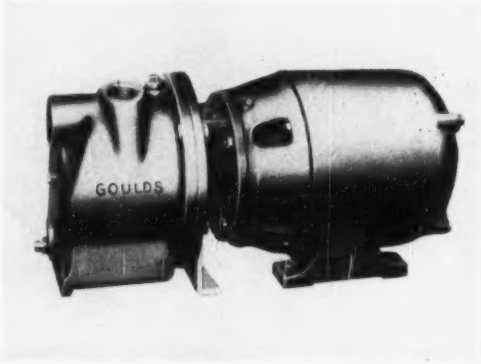


SLIDE-SET VISE is a time saver. Takes approximately one second to open or close vise to any position. Turning handle counter-clockwise throws vise to this neutral position, ready for a fast slide action in or out.

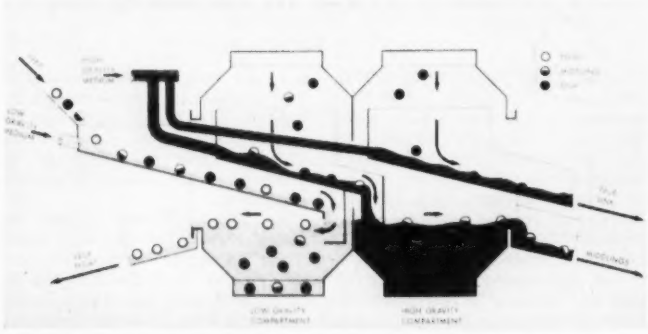
A push closes jaws on work (or a pull will open them) rapidly.



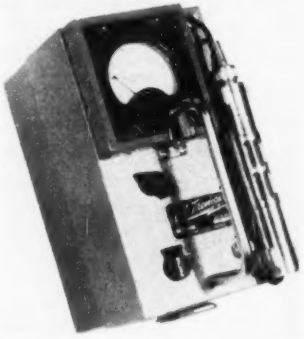
As jaws contact work, a clockwise turn of the handle applies full pressure as positively as conventional models. Dodge Mfg. Co., Mishawaka, Ind. (4)



SELF-PRIMING PUMP uses no valves, no bulky priming reservoir, no recirculation during pumping stage. Efficiencies are comparable to standard pumps. Sizes ¼ to 5-hp., capacities to 120 gpm. Gould Pumps, Inc. (5)



TWO-COMPARTMENT DRUM SEPARATOR obtains a middling product from heavy-density separation simply and without excessive amounts of extra equipment by using two stages of separation, employing media of different gravities in each. Only 3 conveyor systems leave the drum. Made by Western Machinery Co., San Francisco. (6)



GEIGER COUNTER uses 3 scales, 0.2, 2.0 and 20 milli-roentgens per hour, in 3 colors which change with setting of range switch to prevent error. Eltronics, Inc. (7)

Equipment Shorts

KILN MAINTENANCE. An improved method of replacing cracked or worn metal tires on kilns, coolers and driers reduces down time and eliminates much expensive machining. It is based on the use of a diagonally cored split tire. By means of interlocking machined mating surfaces in the ribs, this tire can be positioned in the field without tearing out a section of the shell or disturbing the shell's alignment. After positioning, the split is welded to make a full, solid ring which has no machined bolt-held mating surfaces to loosen under load and heat. Weld metal at the split does not hump up and the tire rolls smoothly over the welded joint. (31)

STEAM CLEANER. An all-electric steam cleaner properly mixes water with the desired amount of cleaning compound, and pumps the mixture through a manifold where it is electrically heated. At 100 to 120 psi, the boiling solution and vapor are ejected from a cleaning gun in a powerful 30 gph. blast that cuts, dissolves and flushes away the heaviest dirt and grease deposits. The portable unit weighs about 300 lb. Available: Homestead Valve Mfg. Co., Coraopolis, Pa. (32)

ACETYLENE GENERATOR. If you do a lot of welding around your shop you might do well to look into this acetylene generator which produces a steady flow of the gas under virtually automatic operation. The unit comes in 5 sizes producing from 500 to 2,400 cu. ft. of acetylene per hour. Available: Sight Feed Generator Co., West Alexandria, Ohio. (33)

HOIST. The Mighty Midget, a hand-operated hoist or puller, weighs 5½ lb., takes up less than a foot of space, yet handles a full 1,000-lb. load on any lifting, stretching or pulling job. Its portability makes it a handy tool to have around the mine or shop. Price: $37.50. A smaller model, weighing 6½ lb. with a 500-lb. capacity lists at $19.75. Available: Colling Hoist Co., Danville, Ill. (34)

OFF-THE-ROAD TIRE. Especially designed for front wheels to make steering easier, this new Goodrich Universal tire has a ribbed tread especially engineered for the purpose. Sizes: 12.00-24, 16 ply rating; 13.00-24, 18 ply rating; and 14.00-24, 20 ply rating. Available: B. F. Goodrich Co., Akron, Ohio. (35)

ROOF BOLTING. A Hole Diameter Gage provides a simple, accurate check method for keeping roof bolt hole diameters within allowable limits. Hole diameter can be read on a handy calibrated rod and readings can be easily estimated to the nearest 1/32 in. within a range from 14/16 to 1 16/16 in. Available: Ohio Brass Co., Mansfield, Ohio. (36)

TAILGATE LOADER. A hydraulically powered tailgate loader can easily be installed on pick-up trucks. Trade-named "Lift-O-Matic," the unit can lift 1,000 lb. Hydraulic power is provided by a fan belt driven hydraulic pump with its own self-contained clutch. Pump operates only when lifting power is needed. Speeds up loading and permits one man to handle heavy, bulky material. Available: National Lift Co., Waukesha, Wis. (37)

BLASTING GALVANOMETER. The Atlas No. 4 blasting galvanometer gives resistance readings to an accuracy of less than ½ ohm even when its activating coil is not at full strength. It can check such small resistances as a single blasting cap, and can function as an ammeter in detection of stray currents, a particularly good safety measure in underground blasting work. It affords an extra measure of protection before hooking up the circuit. Available: Atlas Powder Co., Wilmington, Del. (38)

FUEL PUMP. Further refinement in the Cummins fuel system is a 65% lighter, 56% smaller fuel pump. With 2 years of field testing the manufacturers claim it offers longer life easier servicing. Available: Cummins Engine Co., Inc., Columbus, Ind. (40)

SHOCK ABSORBER. Designed to "dead end" cables and to allow for slack when connecting cables to power source, the "Misco" shock absorber is acceptable for shuttle cars or any type of trailing cable used on portable machinery. An encased spring takes up sudden jerks. Hinged link allows the clamp to swivel, preventing fouling of the line. Available: Mossback Electric & Supply Co., Pittsburgh, Pa. (41)

V-BELT PROTECTION. Technicians of Goodyear Tire and Rubber Co. have announced the addition of a special mildew inhibition agent to materials used in making V-belts. (42)

INTRASIT DRILL STEEL offers fast drilling and long life for small diameter holes for roof bolting, secondary drilling. Available: Rock Bit Sales & Service Co., Philadelphia, Pa. (43)

BINS AND HOPPERS. "Pneu-Jet," a pneumatic device imparts a pulsating movement to panels mounted on the inside walls of bins and hoppers. Positive displacement prevents arching, funneling and tunneling. Automatic regulation offers wide range of control. Available: S. A. Leynse Co., Baltimore 2, Md. (45)

BOTTOM-DUMP TRUCK. Several improved features of the new model WDT bottom-dump Euclid are illustrated in catalog folder No. 250. Euclid Road Machinery Co., Cleveland, Ohio. (46)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

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Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	71	78	85
2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
7	14	21	37	44	51	77	84	91

My Name ..... Position .....

Company .....

Address .....

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

BATTERY TECHNOLOGY. Gould Storage Battery Corp., Trenton, N. J., has announced a revised Second Edition of their 40-page, pocket-size handbook of technical instructions and engineering data on the care of motive-power storage batteries. (71)

CRUSHING ROLLS — Practically everything you would want to know about various types of crushing rolls made by Traylor Engineering and Manufacturing Co., Allentown, Pa., is contained in this well illustrated 40-page booklet. (72)

VALVES, FITTINGS. Stainless steel valve, fittings and accessories catalog contains engineering drawings, weights, dimensions, corrosion data and design information. The 48-page job is put out by Cooper Alloy Foundry Co., Hillside, N. J. (73)

PLANT LIGHTING. A concise, 32-page "Planning Guide to Improved Plant Lighting," covering the latest concepts of plant lighting for industry, the benefits for you, and ways to put a planned lighting program into effect, has been published by Benjamin Electric Mfg. Co., Des Plaines, Ill. Subject is covered from management viewpoint, broken down into economics, program development and equipment selection. (74)

LOADING. Mining men may get much useful information from 3 bulletins on loading rock, issued by Eimco Corp., Salt Lake City. Bulletin L1006A covers 10 different tunnel jobs with data on each as available at the time. L1017 covers data from a number of different mines on production loading from draw points. L1018 covers data from contract jobs using multiple loading units in wide headings. (75)

FLEXIBLE VALVES. Perhaps Flex-Valves are the answer to your abrasive or corrosive fluid problem. Here is a 16-page catalog on the pinch-type valves made by Flexible Valve Corp., Palisades Park, N. J., giving performance charts, photographs and schematic drawings. (76)

ELECTRONIC SCRIBER. A new electronically operated scriber, the Capacilog, for the measurement, indication, control and permanent record of variables in your mill or smelter processes, is described completely in Bulletin C2-1 of Wheelco Instruments Co., Chicago, Ill. (77)

STEEL SELECTION. A 4-page folder listing all popular grades of hot-rolled and cold finished carbon and alloy steel bars with principal characteristics, mechanical properties and uses, is offered by Joseph T. Ryerson & Son, Inc., Chicago, Ill. (78)

CARBIDE BITS. A picture story presentation in 20 pages shows how to successfully recondition tungsten-carbide bits. This book, issued by Rock Bit Sales & Service Co., Philadelphia, Pa., also contains helpful suggestions for drillers on how to obtain maximum speed and footage out of carbide bits plus a complete catalog on Rok-Bits. (79)

WELDING SUPPLIES. Lincoln Electric Co., Cleveland, Ohio, offers a directory of supplies for arc welding operations. (80)

ROLL CRUSHERS. Improved twin and triple roll crushers are the subject of a 16-page bulletin from Pioneer Engineering Works, Minneapolis, Minn. Besides describing and illustrating application of the roll crusher, it contains tables and information to help you select the proper type and size of crusher for the job. (81)

DIESEL LOCOMOTIVE. The advantages of diesel locomotives for underground haulage in general, and the benefits of the North British "Miner" in particular are covered briefly but thoroughly in this foldout from North British Locomotive Co., Ltd., Glasgow. (82)

NICKEL ALLOYS. Two 24-page bulletins on the properties of high nickel alloys have been issued by International Nickel Co., Inc. One deals with Iconel and Iconel "X"; the other with "K" Monel and "KR" Monel. Both contain charts, tables on compositions and properties, working instructions and other technical information. (83)

BELT CONVEYORS. Here are 52 pages of photographs and dimension prints showing various drives, tail sections, take-up and intermediate sections available in the complete line of conveyor belts made by Joy Mfg. Co., Pittsburgh, Pa. Complete specifications are given for each model and accessories are also shown. (84)

BIN DISCHARGER. Materials that puck or arch and refuse to discharge by gravity or that aerate and surge through openings too rapidly, can be handled by the two types of bin dischargers described in Bulletin 250 of Stephen-Adamson Mfg. Co., Aurora, Ill. (85)

DIESEL LOCOMOTIVE. Outstanding features of the line of Hunslet diesel locomotives for underground and surface mines are described and illustrated in an 8-page booklet available from Hunslet Engine Co., Leeds, England. (86)

ELECTRIC CABLE. "Simplex Cables for Mining" is a complete round-up of cable used by the industry today, well illustrated with photographs and drawings. This bulletin from Simplex Wire & Cable Co., Cambridge, Mass., contains a convenient table of uses for mine cable, the company product recommended for that use and where to get more information on that product. (87)

PORTABLE SEISMOGRAPH. A portable refraction seismograph is

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For Your Files *(Continued)*

illustrated and described in a booklet issued by Century Geophysical Corp., Tulsa, Okla. Proper use of this light, compact piece of equipment in determining thickness of overburden and depth to bedrock, is also discussed. (88)

SINTERING FURNACES. An 8-page bulletin (#230) illustrates and describes the complete line of Lindberg sintering furnaces. Also included is a substantial discussion of proper atmosphere generators for use in conjunction with the furnaces. Circle No. 89 on the card below to get this literature from Lindberg Engineering Co., Chicago, Ill. (89)

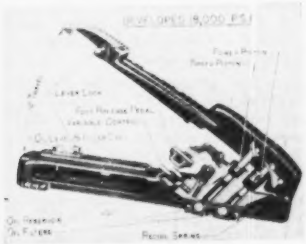
BATTERY CHARGER. All sorts of information on the mine-type battery charger can be found in this folder from Electric Products Co., Cleveland, Ohio. (90)

TRACTOR LINE. Allis - Chalmers Mfg. Co., Milwaukee, Wis., offers a pocket-size, 20-page catalog of descriptions and specifications of each Allis-Chalmers power unit, wheel tractor and crawler tractor. (91)

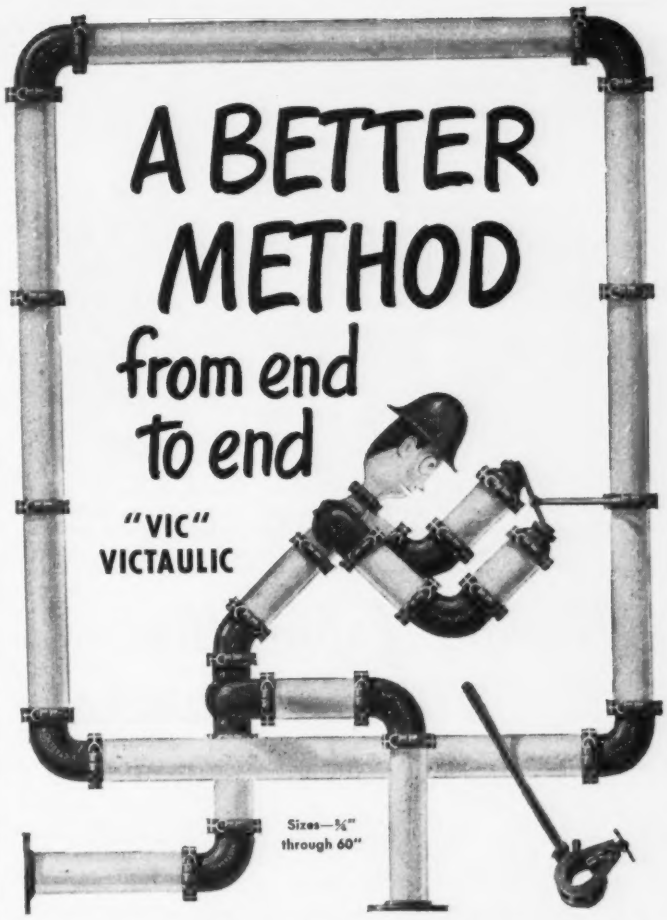
VALVE SIZING CHART. Liquid and gas valve-sizing charts, covering the ranges 0.02 to 10,000 gpm and 1 to 100,000 lb. per hr. respectively, have been published by Fischer and Porter Co., Hatboro, Pa. Charts take into account inlet and outlet pressures, viscosity, specific gravity and temperature. (10)

HEAVY - MEDIA SEPARATORS. Principles of operation and construction details of heavy-density separation devices and wet classifiers are given in 20-page catalog issued by Hardinge Co., Inc., York, Pa. Comprehensive flow sheets and typical operating data are included. (11)

86. CRANE BLOCK. Pamphlet gives diagram and specifications for **American Hoist and Derrick Co.'s** new "Lo-Head" crane blocks, for capacities of 10 to 50 tons. (12)



HYDRAULIC JACK develops 10 to 20 tons pressure making it ideally suited for assembly or disassembly of large parts, forcing fitted parts, and other machine shop applications. The Go-Jak is foot operated and has two speeds. Weight is 10 lb. Made by Wihtol Industries, Eatontown, N. J. (13)



No matter how you look at it, VICTAULIC offers a method of piping that will save time, work, and dollars on construction and maintenance from one end of the line to the other.

The VICTAULIC METHOD is easy, quick, and sure. For joining those pipe ends — two bolts hook up Victaulic Couplings in a jiffy, a standard T-wrench is the only tool needed. AND Victaulic joints stay positive-locked, leak-proof . . . they stand up under extreme pressure, vacuum, or strain conditions!

Grooving those pipe ends is a cinch with the VICTAULIC METHOD . . . "Vic-Groover" grooves 'em automatically in half the time of a conventional pipe threader!

Victaulic Full-Flow Elbows, Tees, and other Fittings are designed for free-flowing efficiency . . . to give complete versatility and dependability to the VICTAULIC METHOD.

You just can't beat the COMPLETE Victaulic System for efficient piping construction . . . it's the EASIEST WAY TO MAKE ENDS MEET.

* * *

Make *your* next piping job ALL VICTAULIC. Write today for these two: Victaulic Catalog and Engineering Manual No. 44, "Vic-Groover" Catalog No. VG-47.

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26TH VICTAULIC YEAR

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The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS

WORLD'S LARGEST RESEARCH LABORATORY devoted exclusively to the development of safety equipment was dedicated in Pittsburgh by Mine Safety Appliances Co. in June. The new laboratory was dedicated to the memory of John T. Ryan, pioneer in industrial safety and co-founder of the company.

Memos from the Manufacturers

- **Total tax bill of 48 of the larger steel companies** amounted to almost $490,000,000, about 172% higher than in 1940.

- New product at the B. F. Goodrich Brecksville (Ohio) research center, is **an atomic golf ball** that can't get lost. A minute quantity of radioactive material imbedded under the cover makes it easy for a Geiger-equipped caddy to find it.

- **The world's biggest dump truck** has been delivered by The Heil Co. (Milwaukee) to a Pennsylvania coal mine. The 28-cu.yd. body can dump a full load in 20 sec. The monster is powered by a 325-hp. diesel.

- **Research, more and more, is coming into its own.** In addition to the John T. Ryan Memorial Laboratory (above), Western Machinery Co. has announced the opening of a Mineral Testing Laboratory in San Francisco, and McCulloch Motors Corp., manufacturers of lightweight, engine-driven equipment, have just completed new research facilities in Los Angeles.

- U. S. Rubber will begin work immediately to **reactivate the GR-S synthetic rubber plant at Port Neches, Tex.,** as requested by RFC.

- **Labor relations** have reached the "Buddy-Buddy" stage at Allis-Chalmers with the company and Local 248 UAW-CIO signing a 5-yr. contract.

- More than 6,800 employees of Minnesota Mining & Manufacturing Co. have received checks for **a share of the firm's profits** for the 2nd quarter of 1950.

The Cleveland office of Robins Conveyors Div., **Hewitt-Robins, Inc.,** has moved to 8905 Lake Ave.

Jeffrey Mfg. Co. has announced the removal of its district office in West Virginia from Huntington to 403 City Ave., Beckley.

Pettibone Mulliken Corp. (Chicago) has acquired **Hammermills, Inc.** (St. Louis) as a wholly owned subsidiary.

National Supply Co. (Pittsburgh) has purchased the assets of the engine division of **Atlas Imperial Diesel Engine Co.**

Joseph P. Mullen, Jr., has been appointed director of flight operations for **Aero Service Corp.**

New assistant manager of sales engineering division of Caterpillar Tractor Co. is **H. J. Hunkle, Jr.**

Henry J. Vines succeeds his brother, **Fred D. Vines** who has resigned, as central sales manager for **Bucyrus-Erie Co.**

Dr. R. H. McCleary has been named sectional director, Application Research Dept., American Cyanamid Co.

Harnischfeger Corp. has a new office in Denver at 1108 15th St.

Koehring Co. has appointed **R. E. Bansemer** to the position of assistant general sales manager.

Louis R. Botsai is now manager of Westinghouse Electric Corp.'s Motor and Control Div. (Buffalo).

International Harvester Co. has made **L. J. Lange** industrial power product specialist.

U. S. Steel Supply Co. has announced the promotion of **Hal P. Kibbey** to the position of assistant Chicago district manager, and the appointment of **Frederick L. Bruckner** as Los Angeles district manager.

Federal Motor Truck Co. has appointed **W. H. Hubbell** as factory sales representative.

Douglas E. Newton has taken over the duties of general sales manager for **Denver Equipment Co.**

M. W. Sledge has been named as manager of Belt Sales Dept. at **Goodyear Tire & Rubber Co.**

Paul C. Cabot has been elected a director of **B. F. Goodrich Co.**

E. J. Kolb has been promoted to manager of export sales by **Crucible Steel Company of America.**

Promotions at **Southwestern Engineering Co.** include **R. V. Gunther** to assistant production manager, **L. G. Janzow** to chief engineer, Mfg. Div., and **James E. Geary** to chief engineer, Construction Div.

Ray Rodolf has been introduced by **Le Roi Co.** as their special sales representative in construction and mining equipment. Located in Arcadia, Calif., he will serve the whole country.

William J. Millett has been appointed manager of the Holyoke works of **Worthington Pump and Machinery Corp.**

Nils Walter Swenson is now assistant manager of branch sales for the mechanical goods division, **U. S. Rubber Co.**

NEVER BEFORE

—a supreme highway tire with positive off-the-road traction!

- **NEW NON-SKID SAFETY**
  —on spearheaded tread—in rain, snow, slush, sleet.
- **NEW ALL-ROAD, ALL-LOAD MILEAGE**
  —vastly reducing all tire costs.
- **NEW JOB-FITTED TREAD COMPOUNDS**
  —to fit every on-and-off-the-road operation.
- **WITH TIME AND TON-MILE SAVINGS NEVER POSSIBLE BEFORE**
  —no more job-failure layover on or off the road.

MADE TO ORDER FOR YOU

In the most rugged strip-mining operation—over jagged roadbeds, up steep, rock-strewn slopes, across roads covered with snow and ice—this new Mid-Century tire has achieved the impossible. Has met and conquered that off-the-road, on-the-road mining combination that no tire has ever challenged before!

COMPLETE PROOF AND JOB-FITTED SPECIFICATIONS BEFORE YOU BUY
A PHONE CALL DOES IT!
Contact your U. S. ROYAL Distributor TODAY

THE GREAT NEW *Mid-Century*

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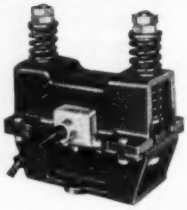
U.S. ROYAL TIRES

UNITED STATES RUBBER COMPANY

Stop wasting—
•Manpower
•And Time
Stop damaging—
•Bins

-hammering and poking arched and plugged bins, hoppers, bunkers and chutes!

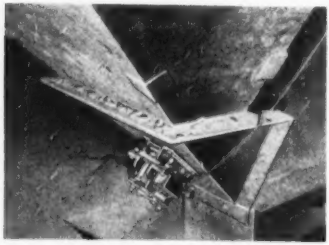
APPLY
SYNTRON
"Pulsating Magnet"
ELECTRIC VIBRATORS



Whether it's a small 1 cu. ft. hopper or a big 100 ton bin — there is a Syntron Vibrator that will eliminate arching and plugging.

The application of the proper Vibrator depends on the characteristics of the material, the size, shape and wall thickness of the bin or hopper.

If you have such a problem, send us the details.



Write for Catalog Data.

SYNTRON CO.
510 Lexington Ave. Homer City, Pa.

Idaho *(Continued)*

★**The Camas silver-lead mine** at Hailey, Idaho, is being developed by the Baltimore Mining Co., owning 60%, and the Camas Mining Co., owning 40% of the property. The property adjoins the Triumph mine. The Camas mine paid two dividends prior to a fire which destroyed the milling plant. The company has just completed a new 150-ton mill.

★**Sunshine Mining Co.** is now stockpiling pitchblende ore which is being produced in development work, pending its final disposition. Whether or not the ore is "any good" is still in doubt, according to R. D. Leisk, manager.

IRON COUNTRY

★**A contract has been awarded** to Associated Builders of Hibbing, Minn., for placing the foundations for a shop, office building and seven houses at Oglebay Norton & Co.'s St. James mine, Aurora. Mining equipment, including shovels and trucks, are expected soon.

★**The new heavy-density plant at the Inter-State Iron Co.'s Grant mine,** Buhl, is now working well. The first one completed by the company, it was designed to handle a layer of ore at the bottom of the Grant pit which is partly decomposed and too high in silica content to be shipped direct. The rock layers are too solid to permit washing in a straight washing plant. During the first two days of operation the silica reduced from 21% to 10% in the concentrates.

★The new heavy-density unit the Inter-State's Hill-Annex washing plant was turned over in the latter part of July and **began handling ore from the pit on Aug. 1.**

★**The Holland mine at Biwabik, idle since 1918 has been leased** by Associated Builders of Virginia and preparations are being made to re-open it.

★**Pickands, Mather & Co.'s Danube mine at Bovey is now a truck and belt conveyor operation,** the belt having been completed this season. Locomotives are used to haul trains from the belt discharge pocket to the washing plant as at some other western Mesabi range mines.

★As a result of the agreement made last November between the M. A. Hanna Co. and the CIO union, **39 men were placed on the pension list in July,** retroactive to Jan. 1, 1950. The new pension plan, effective on that date, includes all employees who retired after reaching 65, within 24 months preceding Jan. 1, 1950. Of these 39 men who are now on the pension roll, 25 are in Minnesota and 14 in Michigan.

★**Stripping at the Inter-State Iron Co.'s Schley mine** at Gilbert is now down to ore in some small areas and is being pushed. The Pettit, which adjoins the Schley, will be developed in the near future. Approximately 2½ million tons have been shipped from the Pettit with about 3½ million tons remaining, according to estimates. It was last operated by the Republic Steel Co. in 1923.

★**The 1949 report of St. Louis County Inspector of Mines,** A. F. Benson, shows 94 mines in operation with 130 inactive. Total employment was 9,680 and the total ore shipments were 42,406,528 tons. Stripping removed amounted to 52,674,642 cu. yd. Mr. Benson reports that total ore and stripping would make a total of 74 million cu. yd.—"an all-time high, not only in St. Louis County, but possibly in the world on projects of a similar type." He gives the average annual movement of dirt on the Panama Canal as 24½ million cu. yd. as a comparison. Fatalities, per 1,000 men employed, were 1.383. Average hourly wage rates ranged from $1.23 for common labor to $2.05 for shovel operators.

★**Jones & Laughlin Ore Co.** will soon begin shaft sinking at a location to be called the Tracy mine. The property is located at Negaunee on the Marquette range. Shaft sinking is expected to begin this fall and first ore shipments are planned for 1954. Within ten years it is anticipated that the Tracy mine will have attained a production of one million tons annually.

★Production and maintenance employees of Inland Steel Co.'s Bristol mine, voting on July 13, **chose the United Steelworkers' CIO** as their collective bargaining agent. Out of 73 men eligible to vote, 44 were cast in favor of the union with 24 against. Superintendent Philip D. Pearson and CIO representative Floyd J. Hill jointly announced the result.

★Professor J. Murray Riddell, head of the mining engineering department of Michigan College of Mining & Technology, states that all of the 37 1950 **graduates in mining engineering have been placed in jobs.**

★With the ore season about the halfway-mark, **Oliver Iron Mining Co. has begun all-rail shipments** of iron ore from the Lake Superior area to eastern mills. President Elstad says that from 150 to 200 cars per day will be forwarded over the various railroads. Rail shipments will go to Pittsburgh and Youngstown plants and the ore will be hauled in gondola type cars instead of conventional ore cars.

★While in Michigan to attend the 100th anniversary of the Cleveland-Cliffs Iron Co., **president A. C. Brown** went underground at the Mather mine and drove a gold spike in a tie in the main drift to mark the linking of the Mather "A" and "B" shafts.

★**"In the interests of security"** the Soo locks have been closed to the public. Only those with special identification will be permitted inside the

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Iron Country *(Continued)*

gates until further notice.

★At hearings to be held at the Iron County courthouse in Crystal Falls in August or September, **discussion will be invited on mineral rights** which result in confusing fractions as they are divided from generation to generation; and the future possibilities and taxation aspects of low-grade ore reserves which are now neither merchantable nor assessable. Both of these have for some years been a problem to tax bodies of the Lake Superior region.

★**North Range Mining Co. is diamond drilling** from lower levels of the Warner mine near Amasa. North Range acquired the mine in October, 1948, and has since dewatered it for examination and exploratory drilling.

★**Employees of the Sherwood mine have received lapel pins** in recognition of having operated without a lost time accident longer than any other underground ore mine of the Inland Steel Co. in its history. A. J. Cayia, manager of mines and quarries for Inland, made the presentations.

★Cleveland-Cliffs Iron Co. is cooperating with the Federal Government in **restricting entrance to its properties.** Beginning at once all tourists and visitors are denied the privilege of visiting its mines and plants. This program will remain in effect until further notice.

★In order to minimize the amount of water that must be collected and pumped from underground, the M. A. Hanna Co. at its Homer mine, Iron River, **is pumping with 14 deep well pumps** located on the surface. It is believed an economy to scalp off as much surface water as possible before it reaches and hampers underground operations. The wells are from 85 ft. to 229 ft. deep and a total of about 6,700 gal. per min. is discharged from them as compared to 650 gpm. by underground pumps.

★About 500 Pickands, Mather & Co. employees in the Iron River district are to vote on **the question of a union shop at the company's mines** in that area. Petitions are being circulated and when at least 30% of the employees in each bargaining unit sign, an election must be conducted by the National Labor Relations Board. At the election, a majority of the bargaining unit must vote in favor of the union shop before the union can negotiate with management on that issue. In other areas where elections have been held, P.M. employees have voted largely in favor of the union shop. The union shop, if finally adopted, would require that employees join the union within a certain definite period; 30, 60 or 90 days after it becomes effective.

★**Jones & Laughlin Ore Co., has awarded a contract** to the E. J. Longyear Co. of Minneapolis to diamond drill its uranium prospect property in Baraga County. A drill rig has been set up and is now at work. Two forties have been leased by the company.

★**Pickands, Mather & Co. is developing the Berkshire shaft** at Caspian as a future central hoisting shaft for ore from the adjacent Buck group, which includes the Buck, Baltic, Fogarty and Berkshire properties, all connected underground. The Berkshire surface plant will be restored, new stockpile grounds provided and a new haulage level developed. A long range plan such as this has involved a great amount of study as to comparative costs of longer underground hauls to a central shaft as against shorter hauls at the expense of more hoisting shafts with their accompanying surface buildings and additional labor, both on surface and underground.

MICHIGAN

★Louis C. Nims, commissioner of the Department of Revenue of Michigan, one of a group which met recently to study the mining situation in the State's Upper Peninsula, has asked that $1,000,000 be appropriated by the legislature to the Michigan College of Mining & Technology to establish a pilot plant for low-grade iron and copper ores research.

In discussing ore deposits of northern Michigan, it was pointed out that the White Pine property of the Copper Range Co. has a potential copper-bearing formation that could, on a tonnage basis, make it the largest low-grade orebody in the United States. A metallurgical problem regarding a refining method new to the Michigan copper mining industry has to be worked out and it is felt that the proposed new million-dollar pilot plant at Michigan Tech would contribute materially to this project.

Franklin Pardee, state appraiser of mines, stated that to the best of his knowledge there are 700 million tons of low-grade ores in the Upper Peninsula.

A committee authorized by the state legislature to study the mining situation in the Upper Peninsula is composed of three state senators and three representatives, all from the U. P.

MONTANA

★**Elkhorn Mining Co.,** operating near Boulder, has made the **first shipment of uranium ore** from its Free Enterprise claim, according to Wade V. Lewis, president of the company. Uranium ore first was discovered on the property by Geiger counter on June 18, 1949.

★**Anaconda Copper Mining Co. is opening and developing inactive mines in Butte,** some of which have not been

operated for 50 years. A new tunnel 6,000 ft. long is being driven to tap ore reserves at railroad track level at the Alice and Lexington mines in the northern section of Butte. The company has increased its zinc production 50% over the prewar era and has doubled the capacity of its zinc plant at the Nashoe smelter in Anaconda.

★**Zonolite Co., Libby**, the largest producer of vermiculite in the United States, earned $645,888 for the fiscal year ended March 31, 1950, or 65c. per share, as compared with earnings of $520,943, or 53c per share the previous fiscal year. A dividend of 15c. per share was paid on June 29, 1950, compared with 10c. per share the previous year. Net sales for the fiscal year just ended amounted to $4,653,356, an increase of more than 11% over the preceding year. Zonolite invested nearly $500,000 in the plant and equipment and other fixed assets during the last 12 months, bringing its expansion expenditures to $1,600,000 since the end of the war.

★**Anchor Mining & Milling Co.** reports the **discovery of what is believed to be uranium oxide** at its properties 29 miles southeast of Helena, Mont.

★Congressmen Mike Mansfield and Wesley D'Ewart of Montana have urged the National Security Resources Board to **put the chrome properties in Stillwater County on a standby basis**, so they can produce chrome concentrates if needed for the present emergency. These properties produced over 100,000 tons of chrome concentrates during World War II.

★**French Gulch Placers, Inc., has taken a lease on the large gold placer** properties of the Bostana Mines Co., in Deer Lodge County, about 18 miles south of Anaconda. A dragline outfit and diesel-electric plant will be installed. Officers of the new company are D. L. Jones, Leroy C. Keil and Herbert Ingman, all of Helena.

★Victor Chemical Works of Chicago, through its board chairman, August Kocks, announces that it will build a **$5,000,000 plant to treat phosphate ores** to recover elemental phosphorus at the town of Silver Bow, about 10 miles east of Butte. Phosphate ores initially will be obtained from the Martin Phosphate Mining Co., operating in Maiden Rock area south of Butte. Electric power for mining and processing will be furnished by the Montana Power Co. from its Montana hydroelectric plants, from its steam electric plant at Billings, Mont., and from power companies in the state of Washington. The new venture will be the largest industrial plant in the Butte district, outside of the Anaconda Copper Mining Co.

★**Martin Mining Co. has purchased for $7,000 the silver mill** of the Moonlight Mining Co., near Maxville, Granite County.

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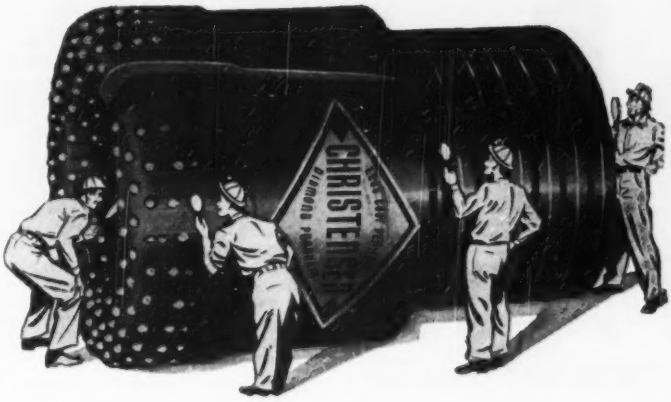

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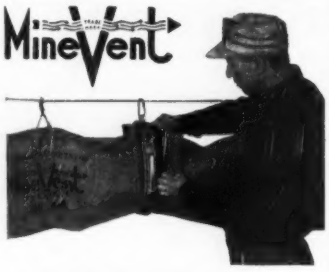

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NEVADA

★Isbell Construction Co., of Nevada has been awarded the **contract to strip and mine by open-pit methods** 3,000,000 tons of ore adjacent to the Morris Brooks mines near Kimberly. The contract was let on July 26 by Consolidated Coppermines Corp., according to A. J. O'Conner, manager.

The project is expected to begin within two weeks and may require three years of work. No estimate of the number of men to be employed has been announced, but officials said the project is expected to be similar in scope to the Getchell Mine in Humboldt County.

Over burden is not included in the 3,000,000-ton total. Mr. O'Conner says the waste will be dumped south and southeast of the pit and as overburden is stripped off, ore will be hauled by rail to the Kennecott reduction plant at McGill. The Isbell company will use diesel shovels, trucks, big cats and carry-alls in the three-year operation.

The work will be under general supervision of the staff of Coppermines, but the Isbell firm will be in sole charge of employing men for the project. Frank Quillici will be general superintendent for the project.

★**High assay values are reported** from the Red Granite mine situated midway between Schurz and Rawhide in Mineral County. J. M. Hicks and D. H. Hicks, both of Schurz, and George E. Miller, of Reno, owners of the property, say the gold ore contains 1 oz. silver per ton.

Present work is being done on an 8-in. vein extending 450 ft. north and south, with gold values on each end. General formation is an altered granite, highly oxidized, with many fractures covering the hill in every direction. Hoisting equipment has been installed and it is planned to drive a winze for exploration purposes, and a small mill may be installed in the area later.

★**Diamond-drilling operations got under way during July on a large block of mining claims on Gold Mountain.** The property is situated 2 miles west of downtown Tonopah. Boyle Brothers, of Salt Lake City, are doing the drilling for Herman Budelman, of Tonopah, and Fred Ninnis, of Oakland. If expected ore-bearing formations are encountered at depth below the cap rock, an intensive drilling campaign to determine actual existence of deep-seated orebodies will start next spring.

Site of the hole now being drilled is only 1,500 ft. from the location of ore deposits mined through the McKane shaft. It is on the Imca group of claims, which are part of a group of 64 mining claims controlled by Budelman and Ninnis.

★Parnell and Charles King, of Albuquerque, N. M., have purchased a turquoise property at Columbus from John Callahan. Columbus is a former mining camp across the dry lake from Coaldale in Esmeralda County.

Several years ago Mr. Callahan discovered a small streak of high-grade turquoise and during the last few years has mined and shipped a large quantity of fine gemstone. The new owners have moved in a compressor from property they own at Royston, and will begin immediate mining.

★**A full line of development machinery has now been installed** by E. M. Booth at his property at Cimmaron, 30 miles north of Tonopah. The machinery includes a heavy-duty diesel compressor. A 400-ft. crosscut will be driven into the hill to intercept gold ore showings that have been opened by previous work done by Booth.

★**A new barium property** situated 15 miles southwest of Winnemucca at Clear Creek is being opened by Jack Tomlinson and J. M. and Lloyd Mullinix, partners in the project. Several potential users are now testing the ore. It is estimated there is more than 10,000 tons of the ore, averaging from 94 to 96% white barium.

★**Black Star Development Co.,** which owns property in the Trego area in Pershing County, reports it is now milling gold ore, recovering free gold, and shipping telluride concentrates to a smelter.

★Ore is being mined by power shovels in open cuts this summer at the **Goldacres property of the London Extension Mining Co.,** of Denver. Their holdings in the Tenabo district between Austin and Beowawe have become one of the state's leading gold producers. The cyanide mill handles 425 tons daily, and the power shovels and trucks handle 2,500 tons of ore and waste daily.

★**Immediately reopening of the Fad shaft enterprise** at Eureka was approved at the last meeting of the Eureka Corp. Ltd.'s stockholders in Toronto. At the close of the meeting George W. Mitchell, manager, wired his assistant to start hiring men and minor repair work was started the next day.

The Fad shaft has been idle since December, 1948, when flood waters were encountered while driving toward the ore zone previously found by diamond drilling.

NEW MEXICO

★The slump in metal mining which threw 1,500 miners out of work last winter in Grants County has disappeared. With prices of copper, zinc and lead up to satisfactory levels since April, **all major mining operations in the district are in full swing.** Miners are getting the highest wage ever paid in the area—$1.40½ per hour.

Kennecott Copper Corp. is on a 7-

day week basis at Santa Rita and Hurley; U. S. Smelting, Refining & Mining Co. is expanding operations at Bayard; American Smelting & Refining Co. and Peru Mining Co., central district, have resumed operations; Empire Zinc Co. at Hanover, is near normal production. Kennecott has also opened its Oswald No. 1 zinc mine at Santa Rita, and is preparing to open Oswald No. 2.

The three potash mines which furnish five-sixths of U. S. potash needs at Carlsbad went into peak production following the 73-day strike last winter. All three, the U. S. Potash Co., Potash Company of America and International Minerals & Chemical Corp., have been making extensive improvements. A fourth company, Duval Sulphur & Potash Co., is sinking its No. 1 shaft and a fifth operator, Southwest Potash Co., a subsidiary of American Metals, is doing exploratory work.

★**A new Bureau of Mines building is being planned at Socorro,** following approval of advance funds by the General Services Administration in Washington, according to Dr. E. J. Workman, president of the New Mexico School of Mines. Also planned is a new laboratory and office building for the State Bureau of Mines & Mineral Resources, a division of the school. This will be erected with New Mexico money, and will cost approximately $80,000. Another $62,000 will be spent on a golf course and recreation area.

★**Superlite Materials Corp.,** recently formed merger of Pumex Corp. and Builders Supply Corp., of Phoenix Ariz., and the Superlite Corp. of Calipatria, Calif., started operations in Albuquerque, N. M., Aug. 1, with 40,000 blocks per day capacity. The new plant is operating with 60 employees in round-the-clock shifts.

Announcement has come from Washington that the Reconstruction Finance Corp. has approved a $50,000 loan to the new enterprises.

The company will use six 35-cu. yd. dump trucks to transport pumice from leased deposits on the Santa Clara Indian reservation northwest of Santa Fe, and four other large trucks with semi-trailers to deliver the blocks throughout the state and trade territory.

OREGON

★All operatives of the Oregon state department of geology and mineral industries have been cautioned by F. W. Libbey, department director, to be on **continuous lookout for evidence of manganese deposits.** Informing Governor Douglas McKay of his action, Libbey wrote: "In relation to the present unsettled condition in Asia, a large tonnage deposit, even though low-grade, might be especially valuable." He added that the depart-

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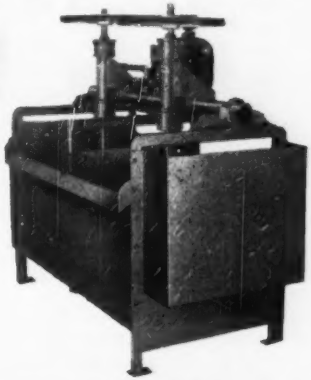

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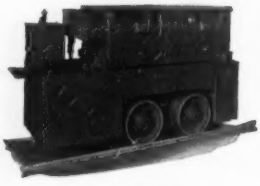

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Oregon *(Continued)*

ment's current study of tungsten deposits near Ashland is timely because of the urgent need for field investigations designed to uncover new sources of war minerals.

★**Possibilities of obtaining ore shipments to the Tacoma smelter** from mining districts of Oregon were investigated late in July by David A. Somerville, ore buyer for the smelter. Districts in the southwestern and northeastern part of the state were visited.

★**A newly organized Portland company** has purchased the Baker Dredging Co.'s Sumpter Valley dredge and plans to work new ground tested several years ago in the lower valley. The company, known as the Powder River Dredging Co., is headed by Carl Deibolt of Portland. L. A. Skillings is resident manager.

★**An expanded development program** is being planned for the Buffalo mine in Grant County. The company proposes to bore a long adit tunnel to explore the veins at a vertical depth of 650 ft. In the company's operations, which have been continuous for the past four years, high-grade gold ore is sorted and low-grade is treated in a flotation plant.

★**A $325,000 expansion program** is underway at the Northwest Electro development laboratory at Albany, producers of zirconium.

Stephen M. Shelton, regional director of the U. S. Bureau of Mines in charge of the laboratory, announced that most of the money would be used in expanding and improving the rare metals pilot plant, and doubling its capacity to an eventual 1,000 lbs. of zirconium a week.

The first major zirconium plant in the United States, its construction was supervised by Dr. W. J. Kroll, who perfected the method used in extracting the metal from zircon sand, obtained from the Oregon coast near Coos Bay.

TRI-STATE

★**The Aurora mining district is showing activity,** according to George Moore, veteran ore buyer of Joplin. Moore is interested in the Good Enough mine east of Aurora which has been a good producer of shallow zinc ore from a hard-ground deposit at 90 ft. A 6x6-ft. shaft is now being sunk to the 200 ft. level where a large orebody has been indicated by drilling. The deposit runs across a 20-acre tract and has been prospected across a 40 ft. width. The ore assayed 12% zinc and is 25 ft. thick. The lease comprises 110 acres of land, and is situated southeast of the old Hays City Mine.

★**George Potter,** largest independent operator in the Tri-State district, has

leased the Snapp property from the Federal Mining & Smelting Co. Mr. Potter recently bought this property from the Kansas Exploration Co., and later sold it to the Federal company. He has drilled 12 holes all of them in commercial ore. The lead-zinc ores are in a shale formation. A log washer will be installed to handle the shale gangue. The 100-acre property under lease will be mined as a strip mine. The Snapp mill has a capacity of 50 tons per hour, and is complete with a flotation section.

★**Robert Keith** has been appointed chief mine inspector of Missouri for a second four-year term. Mr. Keith resides in Joplin.

The property has been mined both by open-pit methods and by underground methods in the past. Dewey Sims, of Miami, Oklahoma, is associated with Mr. Potter in the operation of this property.

★Howe Sound Co. of New York has announced **plans to erect the nation's only cobalt refinery** at Garfield, Utah. Contracts have been awarded to the Utah Construction Co. with the cost estimated at $1,200,000. Connection of water lines and other site facilities began the first week of August. Plant operation is due by mid-1951.

It is believed in Salt Lake City mining circles that the refinery will be operated by the Calera Mining Co., a subsidiary of Howe Sound. It is likewise anticipated 150 men will be employed at the refinery operation.

The plant is due to process 600 tons of cobalt concentrate daily from Calera's Blackbird Mine located at Forney, Idaho, with the annual anticipated output from the refinery estimated at 2,000,000 lbs. Construction of the refinery is a basic part of a $4-million expansion program by Howe Sound, which is reported building virtually an entire town at Forney as well as mills. Reserves at the Blackbird mine have been set at 1,700,000 tons.

★Officials of the Kennecott Copper Corp. reported that **power was sent flowing through the lines at the new $16,000,000 Garfield electrolytic copper refinery**, the first week in August. The plant is expected to be in full operation by the end of August at which time it will be inspected by visitors to the American Mining Congress in Salt Lake City. The formal dedication ceremonies will be held at a date in mid-September as yet unannounced.

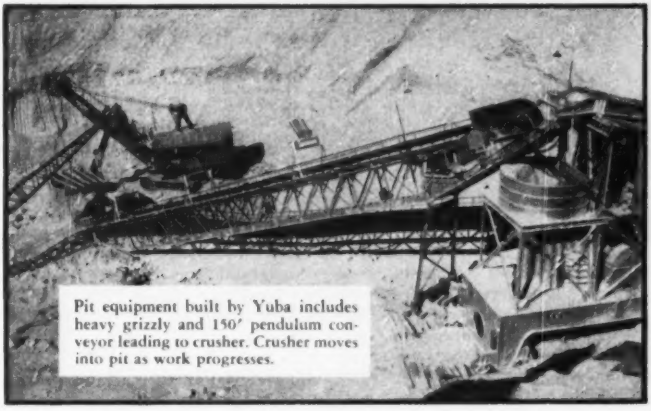
Kennecott announced in July that its new nationwide policy for the pricing of refined copper would take effect when the new refinery reaches full production. At that time, the corporation will abandon the traditional Connecticut Valley price base.

★New Park Mining Co., only major operator in the Park City, Utah, district to remain in full operation over

DREDGE EXPERIENCE *PAYS OFF*

YUBA BUILDS PLANT TO PROCESS 17,000 TONS ORE DAILY

Steep bedrock, porous ground, and pit depth of 375′ made the use of bucket ladder dredges impractical on Round Montain Gold Dredging Corporation's vast ore bodies in Nye County, Nevada. To profitably work the property, a new approach was required.



Pit equipment built by Yuba includes heavy grizzly and 150′ pendulum conveyor leading to crusher. Crusher moves into pit as work progresses.

COMBINATION METHOD SOLVES PROBLEM

Yuba engineers, in cooperation with Mr. W. C. Browning, Vice-president and consulting engineer of the Corporation, designed a plant that is basically a combination of gravel and open pit mining methods coupled with a dredge-type treating plant. A shovel and rail mounted crusher with pendulum conveyor handle the ore in the open pit. Belt conveyors carry the ore from pit to stockpile. At the stockpile, YUBA erected a complete dredge-type treatment plant, with revolving screens, jigs, gold tables, sand pumps, sand wheels, and tailing stacker. This YUBA-built plant is capable of moving 17,000 tons of ore from pit, through mill, to tailings every 24 hours.

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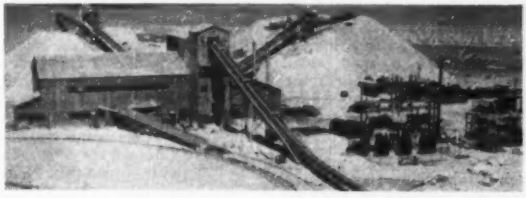

Plant combines dredges and hard bedrock processing methods.

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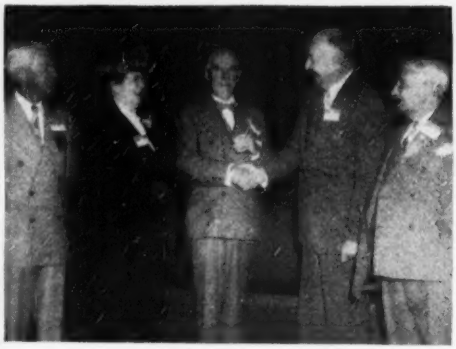
Montana Association Meeting Features Economics



DR. FRANCIS A. THOMSON (center), president, Montana School of Mines, receives congratulations from Dr. George A. Selke, chancellor, University of Montana. Mining Association meeting paid tribute to Dr. Thomson for his contributions to education, the industry and the state. Looking on are (l. to. r.) O. P. Chisholm, president Montana Mining Association, Mrs. Francis A. Thomson, and Carl J. Trauerman, secretary, manager of the Association.

A TWO-DAY annual meeting of the Mining Association of Montana, held at Butte July 30-31 was devoted principally to economic subjects, silver legislation, tax burdens, manganese resources, research into development of low-grade deposits, and the effect of Russian-American relations on the mining outlook. On the technical side, **J. W. Feiss**, assistant to director, U. S. Bureau of Mines, described the mining research activities at the Mt. Weather experimental mine, Virginia.

The meeting paid special tribute to **Dr. Francis Thomson**, president of the Montana School of Mines for his contributions to mining education, to the industry and the State of Montana.

Tom Lyon, of Salt Lake City, asserted that Western copper, lead and zinc mining would be seriously affected by any curtailment of the silver purchase program. **F. A. Linforth**, Anaconda Copper Mining Co., Butte, stated that, although the U. S. is only 10% self-sufficient on high-grade manganese, the country could be made abundantly self-sufficient by utilization of high-cost resources. **Prof J. P. Spielman**, dean of mining, State College of Washington, endorsed an extensive program of research into utilization of low-grade resources.

Evan Just, editor, *Engineering and Mining Journal*, predicted that a warmed-up struggle against the Soviet dictatorship would affect our lives profoundly, through higher taxes, price and distribution controls of short materials, increased demand for mine products, subsidies for high cost producers of controlled materials, and Government loans for exploration, extra development, and surplus facilities. **R. H. Glover**, Anaconda Copper Mining Co., Butte, described the interdependence of large and small mining operations and attacked the attempts to reduce depletion allowances as particularly detrimental to small operators and development of prospects.

Utah *(continued)*

the past year, has **signed a contract with Local 4264, United Steelworkers of America, CIO.** The company, represented by New Park President W. H. H. Cranmer, reported "negotiations were conducted in a cooperative manner, and we feel the agreement marks a new step toward harmonious labor-management relations here." George Haycock, USW regional official, was the top union officer in the negotiations.

The contract includes: A two-year agreement with a one-year clause permitting reopening of discussions concerning wages. A 5c. per hour wage boost is provided retroactive to July 1, 1950; other provisions include a job evaluation study, union shop, three weeks vacation after fifteen years of service, plus new social insurance provisions in which the company pays coverage of workers at a cost of some 3c. per hour.

★**The labor situation in the Beehive State worsened** considerably during July and early August. Difficulties began July 1 with a strike by CIO United Steelworkers which idled 1,333 employees of the United States Smelting, Refining and Mining Co. Properties affected were the Lark and Bingham USSR&M mines, and the Midvale smelter.

The situation was made more gloomy when fire trapped five maintenance crew members in the Lark mine July 16. The bodies of two men were recovered from the Lark shaft via the Mascotte Tunnel July 17. Fire fighting crews continued to attack a blaze on the 500-ft. level in the 5,826-ft. incline for nearly two weeks. By that time, depth of water at the 1,000-ft. level of the Lark shaft was estimated at 15 ft., with much pumping still required before a full search could be made for the other missing men. Hope for their safety was abandoned July 20.

On Aug. 1, picket lines were established by the United Steel Workers at mines in the Park City district—Park Utah Consolidated, and Silver King Coalition Mining Co. One hundred and twenty men had been engaged in developmental work at Park Utah's Keetley unit and 16 men at Silver King. The latter mine had not been operative since a July, 1949, shutdown due to pricing difficulties. With Park City Consolidated shut down for a year, the sole remaining operation in the district is the New Park Mining Co.

★New finds of uranium-bearing ores have occurred about one and a half miles west of present workings in the Marysvale, Utah, uranium district. According to R. N. Cooper of Bullion Monarch, the finds, made on claims of Don MacIntosh and John Henry of Marysvale, indicate the Marysvale deposits are somewhat more widespread than previously believed. The new ore, made in an 8-ft. swath 3 ft. underground, reportedly tested .3% uranium oxide and was found in conjunction with intrusions of monzonite.

★**The Utah Mining Association elected three new directors** at its Aug. 1 session and likewise elected representatives to the board of governors, Western Division, AMC.

The new directors are: Hugo Johnson, manager, Midvale Smelter, United States Smelting, Refining and Mining Co.; C. R. Fish, ore buyer and assistant to the general manager, American Smelting and Refining Co.; and James K. Richardson, Western Mining Division, of Kennecott.

Those elected to represent the Utah Mining Association on the AMC western division board of governors were Darwin Pope, American Smelting and Refining Co., and E. R. Goodner, American Gilsonite Co.

WASHINGTON

★The Anderson mine, near Leadpoint, which had been closed for about a year, has been **reopened by Goldfield Consolidated Mines, Inc.** The ore is trucked to the company's Sierra zinc

daily capacity. Cy Higginbotham is general superintendent.

★**Members of the Chelan miners' union,** local 379, accepted contract terms of a negotiating committee, with the Chelan Division of the Howe Sound Mining Co. at Holden. The agreement provides for a union shop and a health and welfare program, providing life insurance up to $1,500, sickness and accident benefits at $35 a week, with medical and hospital benefits for employee and his family. The cost of the program affecting employees will be paid by the company, but the cost for miners' families will be paid by both company and miners. A three-week vacation for miners after 10 years' employment is another benefit included under terms of contract.

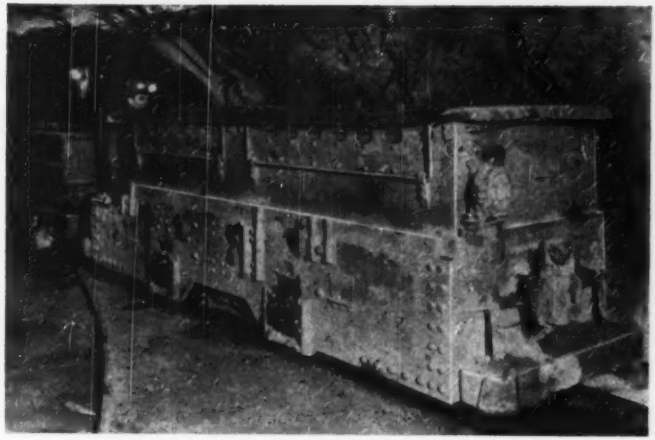
★Grandview Mines, Inc., with property in the Metaline district, will pay **a 1c. dividend** on Sept. 15, bringing the total paid by the company to 16½c. per share. It paid a previous dividend in 1950 of 2c. a share. The mine is being operated by American Zinc, Lead & Smelting Co. on a 50-50 royalty basis.

★**Washington's output of zinc** during the month of May was 1,215 tons, compared with 1,145 tons the previous month. The monthly average for 1949 was 895 tons. Lead production for the state in May was 975 tons compared with 775 tons in April and a monthly average of 536 tons for last year.

★**A prospectors' course,** open to interested persons above high school age, will be offered again this fall by the School of Mineral Engineering at the University of Seattle.

★**Plans for building a larger mill for Bonanza lead mine** and the Old Dominion near Colville, have been delayed until 1951 or until war conditions will permit the manufacturing and delivering of mill equipment, according to Earl D. Gibbs, managing director. Instead of the present mill capacity of 100 tons will be increased to 200 or 225 tons with machinery ordered or likely to be available. Crews have opened a tunnel begun in 1883, at the Old Dominion, Mr. Gibbs stated, and have driven 400 ft. south with 100 ft. to go to reach the "bridal chamber". The tunnel must be driven about 1,000 ft. south to reach the Ella ore deposit. New holes were drilled at the Bonanza to open a fine orebody on which the company is now mining. Ira M. Hunley of Spokane is a partner in the mining company with Mr. Gibbs.

★**The processing plant of Columbia Gypsum Products, Inc.,** near Velox, east of Spokane, was said to be nearing completion late in July. The company has qualified another issue of 25,000 $1 shares under SEC regulation A to be used as working capital. Clyde Reeder of Spokane has been awarded a contract to open-pit mine its deposit near Windermere, B. C.



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IN CANADA

• Porcupine Output Exceeds $1 Billion

• Gaspe Copper Plans Big Production

CANADA

★**Dividends paid by Canadian metal mines this year may reach the second highest total in history.** They can hardly reach the top heights of 1949 when shareholders endorsed checks to the volume of $117.8 million, but they could easily pass the previous high of $108.5 million registered in 1941.

Payments for the first six months of 1950 totaled $53.9 million, the biggest contributors being Consolidated Smelters and International Nickel with $12.6 million.

ONTARIO

★**Kerr-Addison Gold Mines continues to set the pace** as one of Canada's gold mining sensations, with more high-grade ore developed at depth and with earnings in the first half of 1950 more than two-thirds the amount earned in all of 1949.

On the 2,050-ft. level the No. 21 orebody now has a length of 1,190 ft. averaging 0.41 oz. across 27.4 ft. before dilution, a grade well above mine average. Production this year has been running over $1 million per month, and net profits for the first six worked out to $2.6 million or 56.7c. per share, compared with 83.5c. in all of 1949. This despite an increase in costs from $2.74 to $3.10 per ton, recovery having risen from $6.65 to $8.10 due to the mining of ore from higher grade sections.

★**Everything points to a new high this year for American Nepheline Ltd.,** Canada's leading producer of nepheline syenite, with plant at Lakefield in Eastern Ontario. Operating profits soared in the first six months to 119,293 compared with $37,492 in the corresponding period of 1949. Sales tonnage in the half year was upped by almost 18%.

★**One of Kirkland Lake's oldtimers is being revived** by an injection of new capital for another development try. It's the old Beaverhouse Lake property in Gauthier and McVittie twps., idle since underground work was stopped just before the outbreak of World War II. A new company has been formed, Lake Beaverhouse Gold Mines Ltd., with finances supplied by Toburn Gold Mines, subsidiary of American Smelting & Refining Co.

★**Campbell Red Lake Mines is making good progress** in paying off the loan from parental Dome Mines with which mill construction was financed. Operating at a 400-ton rate the mine produced $1.1 million in the first half of 1950 from 67,871 tons to register operating profits close to $500,000. These profits enabled the company to whittle down the debt by $380,000 at the half year, with expectations that an additional $400,000 may be repaid by the start of 1951. If this materializes, the loan would then stand at $1,570,000.

★**Daily milling rate of MacLeod-Cockshutt Gold Mines reached a new high** this summer, with an average of about 500 tons per day. Production during the current fiscal year, which ends September 30, has been somewhat higher than that of the previous period, and net profits will probably show a slight increase over last year's 2.6c. per share. Next year, with full benefit of tonnage from the new "F" zone, earnings should be increased substantially.

★**Stolen gold** would seem to be just about as "hot" as any other stolen valuables, to judge by the misadventures of thieves who broke into the vault of Coniaurum Mines in Schumacher, Ont., to make off with three bars of the yellow metal worth $100,000. After a successful getaway in the dark of night the safe-crackers' car caught fire on the highway south of Timmins and was completely destroyed. Surprised searchers found the gold in the vehicle's abandoned ruins.

★**Another Cobalt area silver mine is slated for production this fall,** Cobalt Lode Silver Mines having acquired the former O'Brien mill at Mileage 104 from Silanco Mining & Refining Co. The plant has rated a capacity of 100 tons daily, but operations are expected to start at 50 tons, with ore to be trucked from the mine, a distance of five miles.

Although this will be the start of milling for the company, it will not be its first production. Since development work was started in the early part of 1949, more than $175,000 has been secured from high-grade ore that was bagged and shipped.

★**Newlund Mines continues to develop ore of big width and good grade** in the two gold orebodies being developed on its 200-ft. level. The mine, which has been a headliner since the start of drifting five months ago, and which has been responsible for the biggest Canadian gold rush in years, appears to be an assured producer. At least 3,000 tons of ore per vertical foot are indicated on the one developed horizon, and plans are now in hand for deepening the shaft to open a second level at 350 or 400 ft. No

estimate of grade is yet possible, but there is no question that profits should be substantial.

★**Cumulative gold production of the Porcupine camp** passed the billion-dollar mark this summer, an amount that exceeds 50% of all the gold that has been mined in Ontario. First gold brick in the camp was poured in 1911, since which time more than 117 million tons of ore have been pounded through the mills, with gold output in excess of 33.7 million ounces. Also important, though outshone by brighter metal, is the incidental production of 6.4 million ounces of silver.

Although the production list includes many companies, three-quarters of Porcupine's wealth has been turned out by the "Big Threes"; Hollinger, McIntyre and Dome, all of which were among the first mines to be discovered, and all of which have been paying dividends steadily for many years.

QUEBEC

★Surface drilling at the Fourniere twp. property of Norlartic Mines has indicated a **new high-grade gold zone** that could have a marked influence on the company's future. Located about 1,100 ft. north of the shaft the new structure lies in a heavily overburdened section that has never been previously explored. Preliminary work indicates a length of at least 300 ft., with grade and widths better than those in the original mine area, where underground work was resumed this spring. Former work there indicated approximately 600,000 tons ore above the 550-ft. horizon, with average grade 0.17 oz. per ton.

★**Interest has increased in the Gaspe area** on the south shore of the St. Lawrence River near the Gulf, where Gaspe Copper Mines, Noranda subsidiary, is making plans for big-scale production. Among the companies which have taken up ground are Buffalo Canadian Gold Mines which has optioned two groups of claims, and Holland Gaspe Mines, with ground adjoining the Noranda property on the south. The latter company is being financed by Conwest Exploration Co.

★Although higher copper prices helped in the second quarter, Waite Amulet Mines wasn't able to overcome the handicap presented by lowered grade and higher development costs. Estimated net for the half-year was $1,468,000, equal to 44.5c. per share, compared with 97c. in the coresponding period of 1949. Dividends were reduced accordingly, from 80c. to 50c. per share.

★**First results of production at Bevcourt Gold Mines** in Louvicourt twp. suggest that grade will exceed the anticipated 0.2 oz. per ton on which plans were based. Officials express themselves as well pleased and, if the

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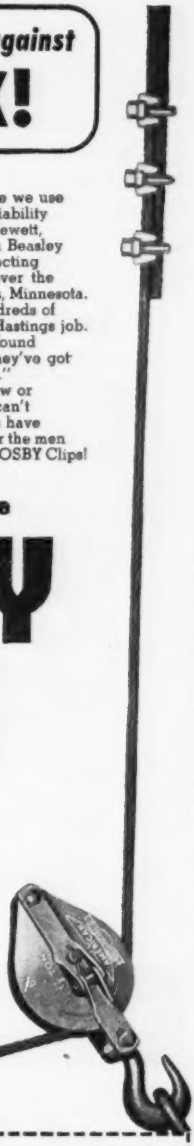

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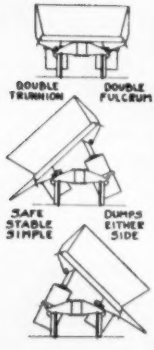

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Canada *(Continued)*

test continues to give encouragement, will probably make plans for larger scale development. Bevcourt's ore is being treated at the adjoining Perron mill on a contract under which 50,000 tons of ore is being mined and milled at the rate of 500 tons per day. The test will occupy Peron's full milling facilities until early fall, in the meantime the latter company is catching up on its own development schedule.

★Reflecting improved operating results, **Malartic Gold Fields doubled its working capital to $1.4 million** in the first half of 1950. Production was over $2 million during the period, compared with $1.4 million in the first half of 1949, average daily tonnage having been upped from 1,244 to 1,673 tons.

★**Continued encouragement is also being had by East Malartic Mines,** located west of Gold Field on the Malartic area greenstone belt. From the low point reached after the disastrous shaft fire of 1947, East Malartic has made its way up the comeback trail to the stage where all bank loans have been retired and working capital stands at $750,000. In the first six months of 1950 the mill handled 203,856 tons for gold production of $1.3 million, versus 154,885 tons and $857,000 in the corresponding period of 1949.

★**National Malartic Gold Mines has started a new surface drilling program** on its property north of the producing section of Malartic. The company originally had two properties in the area, but one was sold in 1948 to Barnat Mines for stock which was later distributed to National shareholders. Prior to the start of the new program only limited exploration had been done on the remaining group, which has been idle since 1939.

★Plans are being finalized for the new three-compartment shaft at the Dubuisson twp. property of **Shawkey (1945) Mines.** To reach a depth of 1,000 ft., the shaft is expected to start its downward course by the end of September. Its site is 2,600 ft. south of the original workings and is on the No. 10 zone where surface drilling returned gold values along a length of 1,600 ft. The property has been idle for several years.

★**Initial production by Quebec Iron and Titanium Corp.** is expected to materialize by December of this year. Refinery construction at Sorel, 40 miles east of Montreal, is proceeding on schedule, and good progress is also being made with the railway that will carry the ore from the mine at Lake Allard, 400 miles east of Quebec City, to the St. Lawrence River at Havre St. Pierre.

First production will be experimentally small, but full production sights are aimed at 250,000 tons of titanium oxide and 175,000 tons of

high-grade iron annually. The company is jointly owned by Kennecott Copper and New Jersey Zinc Co.

MANITOBA

★**Ogama-Rockland Gold Mines Ltd. reports June production as** $42,500 from milling of 4,073 tons, bringing the six months' total to $241,429 from 24,862 tons, an average recovery of $9.67. Drifting on two new levels, the 875 and 1000 ft. has so far failed to disclose ore.

★**God's Lake Gold Mines Ltd. is exploring gold showings** on its claims held at Island Lake. Some 2,000 ft. of diamond drilling is planned for this summer.

★Northern Chemicals which has a lithium deposit at Cat Lake, 90 miles northeast of Winnipeg, is reported planning the **erection of a 100 ton concentrating plant.** The Company has cleared a 2 mile road right of way from the mill site to the new provincial road being constructed into the Bird River area.

BRITISH COLUMBIA

★Unsettled world conditions climaxed by the Korean war have caused a **boom in prospecting for radioactive ores** throughout British Columbia. Hundreds of samples of radioactive ores are pouring into B. C. & Yukon Chamber of Mines. The search has been spured by the fact that the government-set price of radium ore is twice as much as last year. Discoveries which indicate possibilities include the Rocher de Boule location of Western Uranium at Hazelton and at Gunn Lake in the Bridge River district.

★**The position of the International Union of Mine, Mill and Smelter Workers** as bargaining agent at the Consolidated Mining & Smelting Co. of Canada's Trail plant is not causing the government any concern, according to Defense Minister Claxton. The Canadian Congress of Labor executive attacked Cominco for dealing with the IUMMSW which it alleged is under communist control. The smelter produced heavy water, a vital ingredient in atomic research. R. E. Stavert, CM&S president, labelled the CCL statement "iresponsible and misleading."

★An operating loss of $264,564 for the year ended Dec. 31, 1949, is shown in the **annual report of Kenville Gold Mines Ltd.,** which ceased operations at its Nelson district mine in April this year. Operations have now been resumed at the Kenville mill by F. C. Buckland under lease of claims and plant from June 1 to Dec. 31.

★Consolidated Mining & Smelting Co. of Canada is undertaking another major expenditure in connection with

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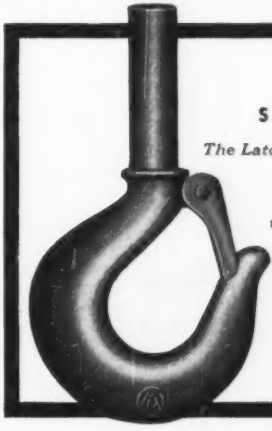
Specify "Laughlin Safety Hooks" when ordering new hoists from your distributor. They pay for themselves many times over in accidents avoided.

Play safe — change over your present Hoist Hooks to LAUGHLIN SAFETY HOOKS

Order from your distributor according to the size now on your hoisting equipment . . . or state the capacity of your hoist and he will furnish the correct Laughlin Safety Hook to fit your needs.



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The Latch Locks the Load

Drop-forged steel, heat-treated . . . stainless steel spring with pressed steel latch. Cast bronze latch on larger sizes. Available for ½ to 15 ton safe working loads.

Send for Laughlin's famous data book of fittings — ask for Catalog #145. THE THOMAS LAUGHLIN COMPANY, DEPT. 5, PORTLAND 6, MAINE.

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3310
½ to 15 tons

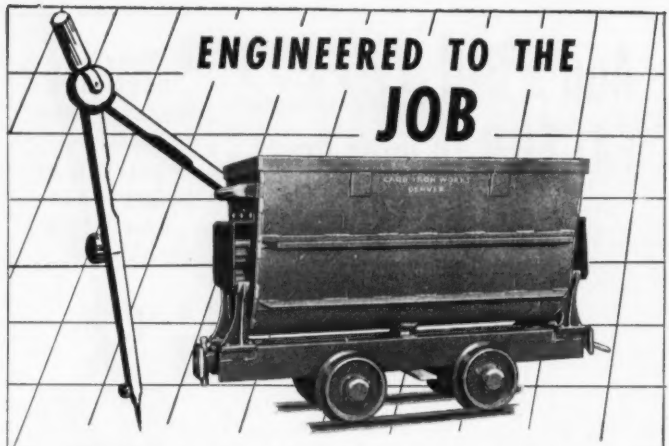
3220
½ to 15 tons

3316
½ and 1 ton

3315
750 pounds

LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS



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C.S. Card Iron Works Co.

Denver, Colorado

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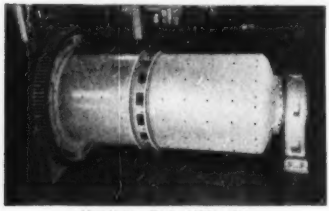
Possibly your grinding operation is not as delicately balanced as that of the gentleman here. However, operating results from numerous Hardinge Rod Mill installations prove its ability to improve product quality and reduce costs.



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Ideal for producing minimum oversize in open circuit grinding. Grinds either wet or dry. Conical heads reduce friction, prevent congestion of charge at the ends, and align the rods. Hardinge Rod Mills with either end or center peripheral discharge, as well as trunnion overflow, are available. Bulletin 25-B-1.

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Canada *(Continued)*

expansion of its Trail facilities. **About $250,000 will be spent on construction of a new pumphouse** to be located at the main reservoirs adjacent to the metallurgical plants at Trail. It will ultimately house all pumps delivering water to Cominco's chemical plants on a level some 350 ft. higher.

★Crews of the Consolidated Mining and Smelting Co. at the Big Ledge property opposite Nakusp on the Upper Arrow Lake **have begun diamond drilling.** Zinc is the chief mineral value which appears in parallel shoots throughout the length of the ledge.

★Reeves MacDonald operations at Salmo have been **showing a gradual increase in production** monthly with peak output of 30,000 tons monthly expected by the end of August.

★Canadian Exploration Co.'s Jersey Lead-Zinc (formerly the Emerald Tungsten) operations in Nelson district **milled 38,170 tons of ore** in the three months ended June 30, averaging 2.17% lead, 6.83% zinc, and produced 5,013 tons of concentrates, with net smelter returns approximately $485,000.

YUKON

★ Good conditions in May and June have given **Yukon Consolidated Gold Corp. Ltd.** a favorable start on its 1950 dredging program. Value of production for all dredges was $201,003 in May and this rose in June to $448,000. June output was materially enhanced when Dredge No. 4 on Bonanza Creek entered a high-grade section towards which it had been working for some time. During 1949, extremely favorable autumn weather enabled the company to dredge until late in November, with the result that total production for the year was greater than that of any year since 1942. Net profit for 1949 was $431,526. Proven gravel reserves stand at 116,427,346 cu. yd., with an average value of 34.94c. These do not include some 29 million cu. yd. at Bonanza Creek, which are only partly proven.

NORTHWEST TERRITORIES

★ **Giant Yellowknife Gold Mines** treated 12,588 tons of ore in June, for a recovery of 10,007 oz. gold and 3,264 oz. silver, with a gross value of $387,911. Calculated millheads averaged 0.87 oz. gold and the average milling rate for the month was 419.6 tons a day. No. 3 shaft was sunk a total of 152.5 ft. in June.

★ **New equipment is being pressed into the investigation** of Salmita Consolidated Mines' most recent finds on the Yellowknife property. A heavy drill has been ordered to supplement

the two now at work. Drilling contract has been let to Boyles Brothers. Immediate objective of the speeded-up operation is to tie up the known north zone with the north zone extension, to round out the ore picture preparatory to shaft sinking slated for later in the summer.

IN LATIN AMERICA

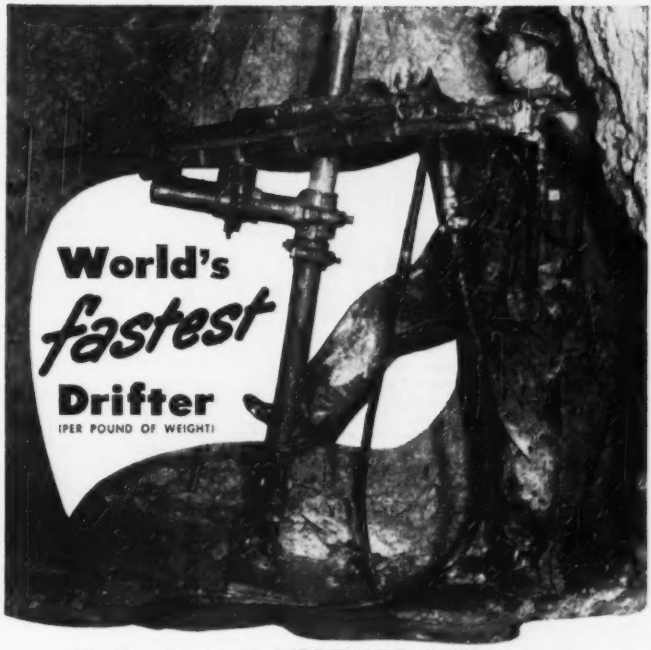
BRAZIL

★Exports of **iron ore from Itabira** will probably reach 1,000,000 metric tons this year, according to Snr. Derneval Jose Pimenta, president of Cia. Vale do Rio Doce, which operates the property. By the end of 1951, production should be up to 2,000,000 metric tons annually. About 75% of this production will be shipped from the port of Victoria, and the rest from Rio. Snr. Pimenta told the Brazilian Society of Mining Engineers recently, in an address, that high grade North American iron ores would be exhausted in another 15 years. He said that Brazil and other sources of high grade iron ore could count on a market in the United States for up to 40,000,000 tons annually of high grade iron ore.

★The Brazilian Government has approved a revision of the contract between the government of Amapa Territory and the **Industria e Comercio de Minerios, S. A.,** for the development of the manganese deposits discovered in Amapa a few years ago. The company is granted exclusive mining rights for 50 years over an area of 2,500 hectares, plus the right to export 500,000 tons of ore annually. Should reserves of manganese ore mount up to at least 10,000,000 metric tons, the company must build a railroad from the mines to the Amazon before the end of 1955. The company is permitted to accept foreign investment, but only as a minority interest.

The company has approached the International Bank for a loan of $35,000,000 to equip and develop the manganese mines, and it looks as though the loan will go through. It has to be guaranteed by the Brazilian Government, and the bank has to have evidence of an assured market. This the Brazilian Government seemed willing to do, and the Bethlehem Steel Co. is reported as willing to sign up for 500,000 tons annually of the Amapa ore, to be bought at the going world price. If this price drops, however, settlement would be based on cost of production plus amortization of the loan.

★The first 100 tons of **manganese ore from Amapa** (see foregoing discussion) went to the national steelworks



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PLENTY of rotation power and drilling speed . . . in a drifter that *one man* can handle — that's what you get when you put Le Roi CLEVELAND PD-24s underground.

Thanks to their short-stroke, double-end-seating valve, these streamlined, one-man drifters are extremely fast and efficient — produce more work, use less air.

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Moreover, you get the right feeding action for any rock from the double-lobe, vane-type feed-motor with its positive control. A floating joint between feed motor and screw eliminates shock and prevents misalignment. And the PD-24's one-piece, ribbed guide-shell provides added strength and stiffness — makes drilling easier and faster.

Weight of the PD-24 (power feed) with 24-inch steel change is only 167 lbs. If you need heavier machines for jumbo operation, 2 additional sizes are available: PD-25 (3½"), and PD-14 (4"). Contact your nearest Le Roi branch for complete facts or write us for Bulletin 127.

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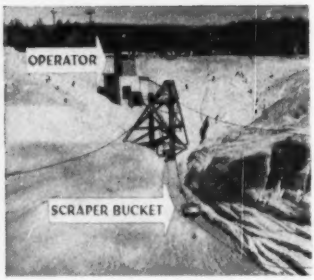

Sauerman Scraper with rapid shifting device at tail end, makes deep cut into hill and moves earth 400 ft. at rate of 2,000 cu. yd. a day to fill an empty mine stope.

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Latin America *(Continued)*

at Volta Redonda as a gift symbolizing the rise of Amapa as a mineral producer.

BOLIVIA

★Minimum prices for metals and strict export controls were established by decree in Bolivia on Aug. 12. All foreign exchange obtained up to the minimum prices set by the decree must be sold to the Bolivian Central Bank at a fixed rate of 60 Bolivian pesos to the dollar. Although exporters of metals can deduct certain dollar costs for production charges, these do not include dollar salaries of American engineers, amortization, or dividends on dollar investments in the mines.

When metal prices rise above the set minimums, exporters are required to sell additional foreign exchange at the 60-peso rate without deductions of any kind.

The decree also requires mine operators to get permission from the Central Bank and from the Mining Bank before buying machinery abroad, paying dollar salaries to foreign engineers, or making transactions of capital amortization or dividends.

CHILE

★On returning to Santiago recently from a two-day trip to Atacama Province, Ruiz Burgeois, secretary for economics, told reporters he was favorably impressed by progress in building the **Paipote copper smelter.** He also spoke in favor of building a small lead smelter at Punta del Cobre, and a cyanide plant at Choapa.

★The Chilean Government is planning to increase the capacity of the **School of Mines at La Serena,** as well as building new laboratories and work shops. About 63,000,000 pesos will be spent on this expansion over the next few years.

★**Copper output,** in metric tons, in Chile thus far this year has run as follows: January, 27,582; February, 27,334; March, 23,853; April, 22,953; May, 30,046; June, 21,122. If production during the second half of 1950 reaches 200,000 metric tons, it is estimated the Treasury will receive an extra $30,000,000 in taxes owing to the higher price of copper and the increase of 50,000 tons over the first half.

COSTA RICA

★**A new manganese concentrator** is scheduled to be installed near the Pacific coast of the country by Costa Rican Manganese Co., Ltd. It will have an output of about 5,000 tons per month of 60% concentrate. The ore-

bodies supplying the mill are estimated to contain over 500,000 tons of manganese ore.

★**The Guacimal lead property** on the Pacific coast is to be put in operation soon. Ore running, it is said, as high as 49% lead will be shipped to the United States.

★**Costa Rica International Sulphur Corporation** is developing surface deposits in the country that are said to contain more than 50,000,000 tons of sulphur. Dr. John Hall, chemical engineer, is in charge of erecting plants to produce both sulphur and sulphuric acid for US and foreign markets.

MEXICO

★According to a review of the Mexican mining industry published recently in the Mexico City newspaper, *Excelsior*, **mining contributes** 22% of the total Federal budget in Mexico. This means about $90,000,000 over the past year.

Mexico now has 2,471 mines in operation, says *Excelsior*, plus 135 mills, 9 metallurgical plants, 7 refineries, and 8 coal mines. Mining's annual production in Mexico comes to $210,000,000 worth of ore, and the industry employs 70,000 workers.

Mexico's rank as a world producer of various metals runs as follows: silver, first; gold, eighth; lead, third; copper, eighth; zinc, sixth, antimony, twentieth; bismuth, fourth; arsenic, fourth; cadmium, second; tin, seventeenth; graphite, seventh; manganese, twelfth; mercury, fifth; molybdenum, third; and tungsten, twentieth.

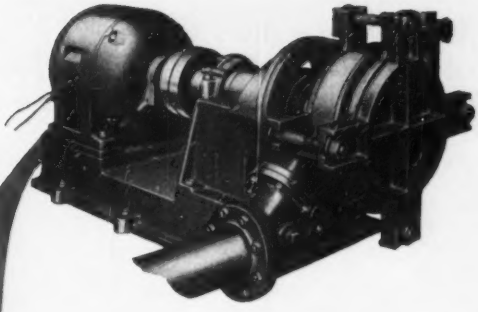
★**The Mexican Mint** is stepping up coinage of new silver pieces. Its goal is to have 30,000,000 peso pieces ready for circulation by Sept. 16, Mexico's Independence Day. The Mint is also working on coinage orders from China, Arabia, Syria, Ecuador and the Dominican Republic.

PERU

★**Cerro de Pasco's** electrolytic zinc plant at Oroya, now under construction, will begin operating by about March, 1951. The plant is designed to produce about 35 tons daily of electrolytic zinc. Total cost will be about $12,000,000. The plant's capacity is believed sufficient to take care of Cerro's output of zinc concentrates, as well as that from other mines such as Huaron and Atacocha.

★**The Yauricocha mine**, located at Yauricocha in central Peru, and owned by Cerro de Pasco, is at present one of Peru's largest copper producers, with a daily output of over 4,000 tons of high grade copper ore. The ore is brought out by a monocable aerial tram, one span of which is over 3,000 ft. long. (See *E&MJ*, July, 1949.)

★**The new Mining Code** that went into effect in Peru on May 12, 1950,



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1 **EASILY DISMANTLED**—Impeller and shaft sleeve can be renewed *without disturbing the suction and discharge piping or the bearings*. Simply loosen 4 bolts . . . slip them out of disc slots . . . and pull off end cover. Four adjusting screws easily close worn clearances on suction side of impeller.

2 **GLAND UNDER SUCTION PRESSURE ONLY**—Since it is not subject to high stuffing box pressures, it is much less vulnerable to abrasive solids. Packing troubles are reduced to an absolute minimum . . . and there is considerably less dilution of your mixtures due to leakage.

3 **CORROSION-ABRASION RESISTANT**—The Morris Type R has no internal studs and bolts . . . no troublesome internal fits and joints. For ore processing, the alloy parts of the Type R stand up under the severe wear of corrosive and abrasive materials. These parts are easily renewed with minimum labor and time.

4 **SHELL IS INTERCHANGEABLE**—Suction and discharge nozzles can be swiveled around the axis of the pump to any of 72 different locations. Changed for either right or left hand rotation.

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IN MINING OPERATIONS, it handles mixtures containing ore concentrates . . . tailings, slag and residue from filters and classifiers . . . all types of caustic or acid mixtures containing abrasives or solids.

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NAGLE Centrifugal Pumps handle flotation froth and heavily laden, abrasive liquids. Mixtures with moisture content so low they will just barely flow are readily moved by Nagles.
The pump shown is a 10″ Type "SW-OX" Frame 238X Pump used in certain facilities at Oak Ridge National Laboratory . . . one of many types of vertical and horizontal pumps for metal mining, ore preparation and refining.
This unit has neither submerged bearing nor stuffing box. The outlet is at the bottom to make it completely self-draining.
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RIB-CONE BALL MILLS

Over 100 sizes and types of Rib-cone ball mills to choose from. For amalgamation and concentration of free milling ores, use a Rib-cone screening mill. Delivers a finished product direct to amalgamation plates. No classifier is needed. Rib-cone mills are also built in grate discharge and plain overflow types.
Also available in sectionalized construction for muleback transportation. Over 40 years leadership in sectionalized construction provides correctly designed equipment that is easily transported and erected in the field. A complete line of mining machinery including tables, crushers, feeders, screens, classifiers, etc.

FOR LOWEST COST CRUSHING

Kue-Ken jaw crushers and gyratories. The exclusive principle of "crushing without rubbing" gives users 5 to 10 times longer jaw plate life. A few of the other features include all mechanism sealed in oil bath. Lubricate twice a year. Automatic overload safety device without shearing or breaking parts. High capacity with low power requirements.

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OAKLAND 20, CALIF., U. S. A.

Latin America *(Continued)*

was designed to stimulate investment in mining and at the same time protect the interests of the Government and the Peruvian people. Claimants are required to invest, after the fifth year of exploiting their concessions, at least 50 soles ($3.30) per year per hectare. The royalty doubles if this is neglected. The Code provides for payment of a royalty and a single tax on profits, freeing the claimant for 25 years from any additional tax. The system of establishing claims has also been greatly simplified by organizing a regional set of mining offices controlling the filing of claims. This system should eliminate the troublesome errors in boundaries that were so frequent under the former code. In general, the new code is a guaranty to investors and should do much to stimulate mining development in Peru.

PHILIPPINES

★Shipments of refractory grade chromite have been stepped up at **Consolidated Mines**, operating at Masinloc, Zambales Province. July commitments have been boosted 5,000 tons, with likelihood they will pass 30,000 tons a month in August. The mine is in good shape to produce. The initial run on the new Heavy Media plant gave fine results after minor adjustments. Percentage of chrome in the final product has been increased while iron has been cut down. The two washing plants have a capacity of about 1,000 tons of ore daily, raising the grade from 28 to 32% chromic oxide.

★**Manganese production** in the Philippines continues to lag behind prewar output. Production in 1949 totaled 26,300 long tons, compared to 46,600 tons in 1938-40. The Luzon Stevedoring Co. operates 11 manganese-ore properties, all of limited capacity. They account for nearly all the production in the country.

★Production at **Benguet Consolidated** in June was 13,536 oz. of gold from milling 61,778 tons averaging 0.22 oz. per ton. For the January-June period gross output was 69,784 oz., which was an increase of 17,000 oz. over the comparable period in 1949. Production for the half year would have been even more if mine and mill operations had not been interrupted by a wildcat strike in May.

IN INDIA

★ The Indian Government recently concluded an agreement with the London firm of Associated Consulting Engineers for the establishment of the **biggest silver refinery** in the East.

It will be located in Alipore, residential area of Calcutta.

Estimated to cost $1,250,000, the refinery is expected to begin work in about two years on the refining of 600,000,000 oz. of silver coins. The resulting 300,000,000 oz. of pure silver will be sent to the United States over the next ten years in return for silver lend-lease of India during the last war.

The refinery will use a process patented in India that is said to be more economical and effective than conventional silver refining methods.

★ India's first plant for producing **uranium and thorium,** used in generating atomic power, will be operating in about six months, according to Mr. K. G. Menon, chief secretary of the Travancore-Cochin States Union Government. The plant will use monazite sands as raw material, a mineral that India has in abundance. The plant, to be built at Alwaye on the west coast, will cost about 10,000,000 rupees. It is a joint venture of the Central and States Union Governments.

IN EUROPE

★**Austrian magnesite** production is to be increased substantially under a recently-announced ECA investment program for the country. Magnesite output has increased from 397,000 tons in 1937 to 503,000 tons in 1949. The ECA program will increase production by another 20% by 1955. A total investment of 90,000,000 schillings is planned, of which 10,000,000 schillings is to come from counterpart funds, and the rest from the industry.

★The ECA late in July granted a loan of $1,494,180 to the Italian mining company, the Soc. per Axioni Piombo e Zino (SAPEZ) to help build **an electrolytic zinc plant** at Mossa in the northern province of Bergamo. Leon Dayton, ECA Chief of Mission in Italy, signed the loan agreement with this comment:

"This is not only the first contract of its kind with Italy, but it is the first mineral development project to be financed with that portion of the counterpart fund reserved for the exclusive use of the USA. The signing of this contract therefore opens a new field of collaboration between the Republic of Italy and the Government of the USA for the development of Italy's natural resources. Although small, this is an important development, and is part of the progress toward ECA objectives, which envisage greater employment and higher living standards for the whole of the Italian people."

The new plant will use low-grade oxidized ores of the Giorno and Oltre il Collo mines in northern Italy. The company also plans to produce 10,000 tons of sulphuric acid annually along

HOW TO GET RID OF WATER ...1950 STYLE

When it comes to getting rid of water in mining operations, you can depend on Naylor light-weight pipe to do the job.

It's easier to handle and install Naylor Pipe. You can string lines over any kind of terrain and know that they will stand up to the service.

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Easily and quickly applied on the job or in the shop. Special design gives deep compression into belting and smooth, flush joint.

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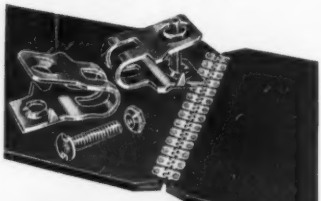

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Mr. Cloyd M. Smith, Mining Engineer of Washington, D. C., pictured above, likes McGRAW-HILL'S PRE-FILED MINING CATALOGS because it is an up-to-date compilation of Buying Information and complete directory of mining machinery, equipment and supplies. He values the thoroughness with which the Catalogs covers the mining field; also the handy way material is arranged for quick reference and checking.

Recently Mr. Smith said:

"This is an excellent compilation of manufacturers information and I appreciate its receipt."

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Europe *(Continued)*

with 10,000 tons of high grade zinc. This production includes about 3,000 to 4,000 tons of zinc now being lost in mill tailings.

Cost of the plant will be about $3,318,400. Included in this figure is the estimate of $505,820 to be spent for machinery and equipment in the USA. Output of the plant will go half to Milan for sale and half to export. The ECA expects that increased consumption of zinc in Italy will take the plant's entire output eventually.

★Early in July, the ECA signed an agreement with the Belgian tin mining company, **Geomines**, for an advance against production of $1,700,000, the money to be used to complete the already high mechanization of the company's tin mines in the Belgian Congo. Geomines has worked this district's richest tin mines at Manono in Katanga Province since 1919. In recent years output has averaged 15,000 tons annually.

★Since resumption of shipments of **Swedish iron ore** to Germany in April, 1950, arrivals of foreign iron ore in Western Germany have increased steadily. Of total contracts concluded with Sweden, Spain, Brazil and other suppliers of ore, amounting to 4,600,000 tons for all of 1950, about 1,800,000 tons had already reached German harbors. Total shipments during July reached 400,000 tons.

The German Ruhr plants now have contracts for 3,500,000 tons of Swedish 60% iron ore, and more contracts are being sought. A contract has also been signed for delivery of 50,000 tons of 52% iron ore from Newfoundland. Shipments of German domestic iron ore to the Ruhr are running about 650,000 tons per month.

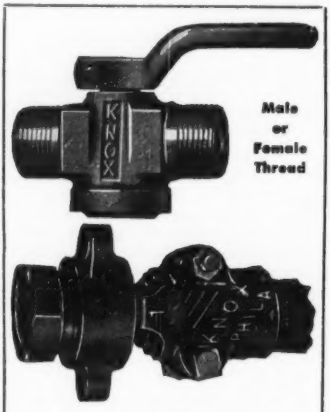
★France's first **important uranium mine** went into production early in July. The ore is said to run about 15 to 20% U_3O_8, but the French won't tell how big the deposit is nor where it is.

★A Danish engineer, Boerge Lunn, has devised **a new bronze alloy** that he says is stronger than steel and is non-magnetic. The alloy was worked out to satisfy a call for a bronze sphere that would weigh no more than 1.6 tons and be non-magnetic and capable of withstanding undersea pressure up to 1,000 atmospheres. The sphere will serve as a diving bell for a Danish expedition that is leaving soon to study extreme ocean depths.

★The Bank of Italy has secured a license to **buy 5,000 tons of nickel** from England to be used in minting 50- and 100-lire nickel coins. Cost will be £3,352,903, and will come out of the large fund of sterling exchange Italy has available in England. This decision was strongly opposed by the Italian association of nonferrous metal fabricators, who felt that the order should have been placed in Canada for raw nickel, rather than for British semi-finished nickel shapes. The Italian fabricators could have refined the metal, and would welcome the job, even though it would have meant paying dollars for the metal instead of pounds.

★**A new zinc and lead smelter** has been established at Bremen, Germany, by Bremen Metalhandel-und Schmelzwerk. The plant is to be used largely for remelting zinc, for which it has a capacity of 200 tons per month. The company is said to have substantial orders from abroad for remelted zinc.

★**The uranium mines** near Buhovo, Bulgaria, have now been equipped with a new concentrator. Mining at Buhovo, a small village about 18 miles from Sofia, has been carried on vigorously ever since all Bulgarian mines were nationalized. The new mill makes a rough concentration only in order to cut down the ore's shipping weight. The destination of the concentrate is unknown. The area has long been a Mecca for tourists because of an old monastery at Buhovo, but the mine has not been worked intensively until recently. The surrounding country is now under strict police control, and the Buhovo mine is said to be the largest uranium producer in the Balkans. Other uranium deposits have recently been found in Bulgaria as well.



Recognized Universally as the ULTIMATE in Valves and Couplings

KNOX MANUFACTURING CO.

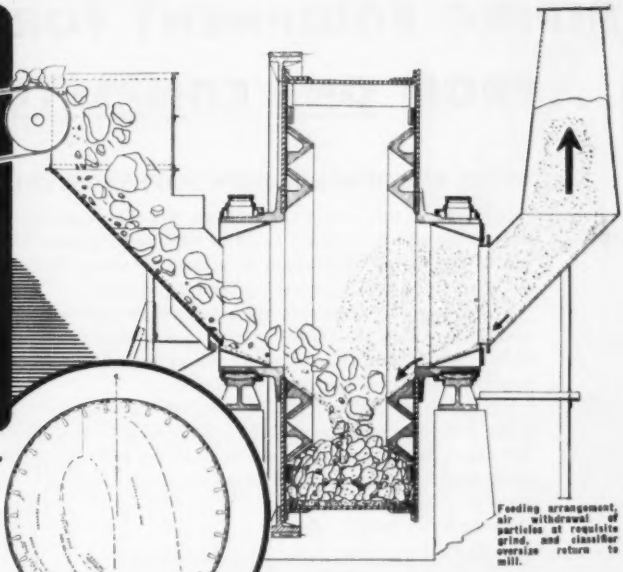
222 W. Clinton Ave. Oaklyn, N. J.

SINCE 1911 PRODUCERS OF

KNOX

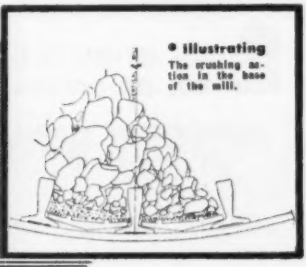
Valves - Couplings - Nipples - Clamps - Manders

Here is the OPERATING and COST DATA on the new "AEROFALL" MILL



Feeding arrangement, air withdrawal of particles at requisite grind, and classifier oversize return to mill.

The Aerofall Mill is a dry, combined crushing-grinding unit, capable of taking run-of-mine minus 18" size material and reducing it, in a single operation, to as fine as 99.8% minus 325 mesh. For a coarse grind, it will produce a product in the 10 mesh range. It will tolerate a moisture content of 3½ to 4% without affecting either capacity or product.



● **Illustrating** The crushing action in the base of the mill.

DIRECT MILLING COSTS

FROM RUN OF QUARRY OR MINE SIZE TO FINAL PRODUCT

Material Description	Final Product Screen Analysis % Minus - Mesh	Milling Rate in Tons/24 Hrs.	Units and Size	Total Power Drawn (H.P.)	Direct Milling Costs Per Ton - Dollars			
					Labour at $1.25/Hr.	Power at $50.00/HP Yr.	Parts & Repairs at Twice Power	Total Direct Milling Costs per Ton of Material
Sandstone - Hard	Minus 28 Plus 150	1100	1-16x5	400	0.027	0.054	0.049	0.110
Quartzite - Tough	Minus 28 Plus 150	500	1-16x5	350	0.060	0.065	0.102	0.227
Gypsum-Limestone	100% Minus 100 85% Minus 200	500	1-16x5	375	0.060	0.069	0.037	0.166
Talc	99.5% Minus 325 Avge. Particle Size - 2.0 Microns	300	2-16x5	740	0.133	0.227	0.054	0.394
Barite	99.5% Minus 325	300	1-16x5	475	0.100	0.156	0.058	0.304
Serpentine-Asbestos	80% Minus 30 Mesh	1200	2-16x5	650	0.025	0.066	0.054	0.145
Lead-Zinc Ore	95% Minus 200	800	1-16x5	450	0.038	0.055	0.020	0.093
Iron Ore - Tough	60% Minus 325	1200	2-16x5	875	0.027	0.051	0.060	0.138
Quartzite - Tough	100% Minus 150 95% Minus 200	250	1-16x5	375	0.120	0.139	0.204	0.463

In the Aerofall Mill, the material itself may be the total charge, or steel or tungsten carbide balls may be added. This mill uniquely combines the action of (1) abrasion, (2) blow impact, (3) free fall impact, and (4) drag. Product is collected in either wet or dry type cyclone.

The Aerofall Mill produces not only a more uniform grind and an ultra-fine product, but will also give, when required, a "differential grind" — meaning that minerals can be handled with minimum of breaking down of their individual crystals. The above drawings illustrate the design of the Aerofall Mill, showing its various actions and why there is a minimum of "slip," with maximum energy devoted to actual crushing, at high speed, making for increased operating economies, as shown in the table of milling costs. In short, the Aerofall Mill represents, in results and in low costs, a revolutionary development in industrial milling, and merits your further careful investigation.

Complete data sent on request

AEROFALL MILLS, LTD.

73 KING ST. W. TORONTO 1, CANADA

PIPING EQUIPMENT FOR MINE SERVICES

...FROM ONE COMPLETE LINE

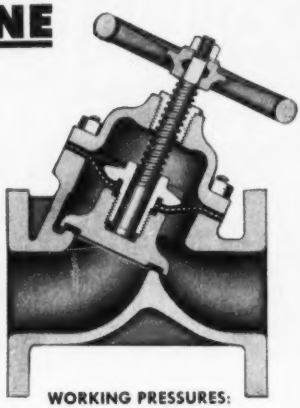
BETTER PERFORMANCE FROM DIAPHRAGM VALVES

Note how, in this new Crane design, the diaphragm is used only to seal the bonnet area—not for seating purposes. Service life of the Crane diaphragm is greatly increased because it isn't subject to cutting, crushing, and rapid wear.

The disc is a separate member which assures accurate seating and positive shut-off of flow—even in case of diaphragm failure. Other outstanding features of Crane design are greater flow capacity and easier operation in all sizes.

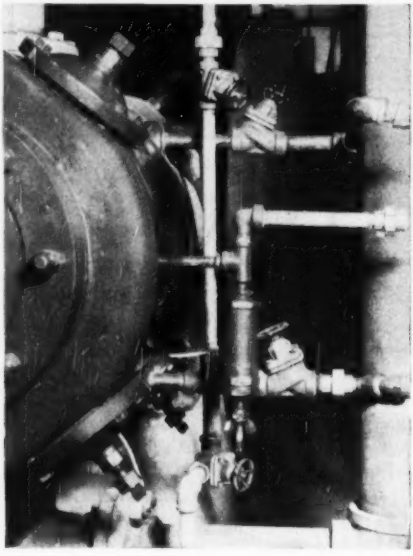
For mine waters, sludges, and slurries corrosive to iron, Crane supplies these valves with Neoprene lining. Unlined valves are highly suited for compressed air and other common mine services. Available in sizes up to 6 in.; screwed or flanged ends. Send for Circular AD-1761.

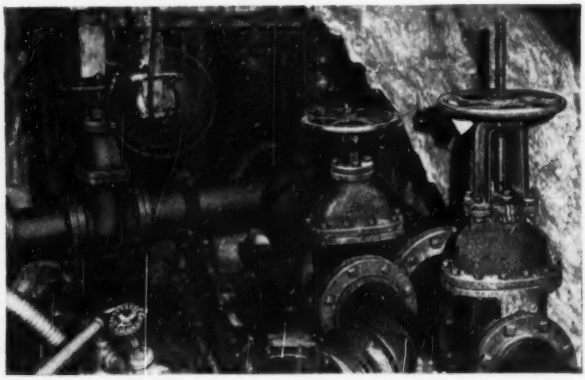
CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



WORKING PRESSURES:
Up to 150 pounds water, oil, air, or gas; 180° F. max. temp. Sizes up to 6 in. Screwed or flanged ends.

ONE ORDER TO CRANE COVERS EVERY POWER, PROCESS, OR GENERAL UTILITY PIPING NEED

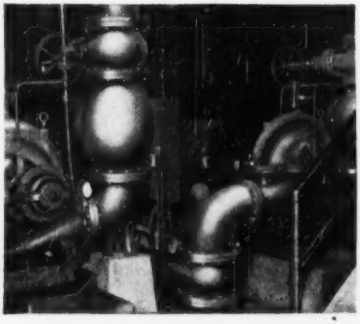




DRAINAGE LINES *in a metal mine equipped with iron valves and fittings from the complete Crane line.*

LINES TO AIR COMPRESSOR *using Crane No. 1610 Iron Body Diaphragm Valves.*

PRIMARY SPRAY PUMPS *in a large breaker plant featuring Crane 125-Pound Iron Body Wedge Gate and Check Valves.*



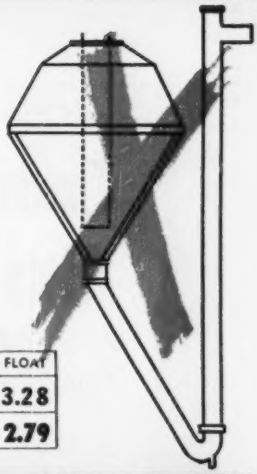
EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

IRON ORE

	% WT.		% Fe		% SO_2	
	SINK	FLOAT	SINK	FLOAT	SINK	FLOAT
CONE SEPARATOR	75.7	24.3	56.6	44.7	12.6	30.5
AKINS SEPARATOR	82.9	17.1	57.3	39.2	11.8	38.4

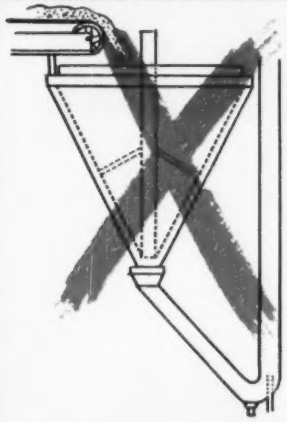


ZINC ORE

	% ZINC		
	SINK	MIDDLING	FLOAT
CONE SEPARATOR	19.00	—	0.86
AKINS SEPARATOR	36.00	9.28	0.63

GARNET ORE

	% GARNET		
	SINK	MIDDLING	FLOAT
CONE SEPARATOR	55.0	—	3.28
AKINS SEPARATOR	91.5	32.9	2.79



Compare the METALLURGY

Wherever Heavy Media Separation processes are used, AKINS Separators have decided advantages over the three designs above. AKINS machines are already considered standard in treatment of iron ore, coal and garnet. New applications are being developed rapidly in other fields, especially coal treatment.

In an AKINS, the mechanical advantages and the metallurgical advantages over other existing types are of equal importance:

MECHANICAL ADVANTAGES

1. Eliminates compressor and auxiliary equipment.
2. Does not plug to interrupt plant operation.
3. Can be stopped and started without draining.
4. Low power consumption, up to 35% less (including auxiliary equipment).

METALLURGICAL ADVANTAGES

(Substantiated by 10 AKINS Separators owned by 6 companies treating iron ore, garnet and coal.)

1. Greater recovery of product.
2. Better grade of product.
3. The only Heavy Media Separator that can recover a separate middling product for retreatment.

HEAVY MEDIA SEPARATION PLANTS:

6 Companies . . . 3 Fields Using AKINS Separators

IRON ORE
- Hanna Ore Co.
- Cleveland Cliffs Iron Co.
- Butler Bros.
- Stanley Mining Co.

GARNET
- Barton Mines Corp.

COAL
- U. S. Coal & Coke Co.

COLORADO IRON WORKS COMPANY

No important installation of AKINS machines has ever been replaced with machines of any other make! For details and free engineering service on your application, write

COLORADO IRON WORKS CO., DENVER 2, COLORADO

Canadian Locomotive Co., Ltd., Kingston, Ont., Can.; Wright Bros., Credit Foncier Bldg., Vancouver, British Columbia Sales Agents; Head, Wrightson & Co., Ltd., Stockton on Tees, Eng.; John Carruthers & Co., (Pty.) Ltd., Sydney, Aus.; Head, Wrightson & Co. (S. A., (Pty.) Ltd., Johannesburg; Edw. J. Nell Co., Manila, P.I.

Completely New Tooth Has 6 Major Features

More and more operators of excavating equipment are specifying the new AMSCO® Rever-SharP

The new Amsco Rever-SharP—designed for use with power shovels, draglines and rippers—is now available in a wide variety of sizes. Th... new tooth combines the ... work-hardening properti... ganese steel with a ... portant construc...

The Rev... exten...

enthusia... too...

1. Manganese Steel Construction throughout—The Rever-SharP actually thrives on hard use . . . *the harder you use it, the harder it gets!*

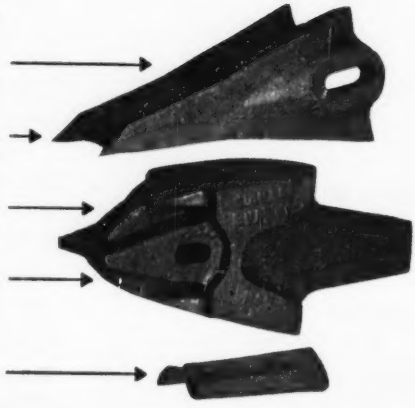
2. Reversible Tip—when the cutting edges of the Rever-SharP are finally worn, simply turn the tip over. *It's self-sharpening.*

3. Reinforced Cutting Edges—specially designed extended corners are the first to work-harden, thus equalizing wear along the entire length of the cutting edge.

4. Heavy, Rugged Adaptor—extra metal protects base connections and lips. Now available for all base connections.

5. Reinforced Adaptor Nose—supported by ribs along entire length, making bending or breakage practically impossible. Special taper makes lips self-tightening during use.

6. Tapered Lock-Key—easy to insert and remove. Has rubber insert—can't work loose in service.



Enthusiastic users of the new Rever-SharP report higher digging efficiency—and as much as 6 times longer tooth life. *It's a new development worth investigating—write today for the complete facts!*

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

TRAVEL 25% FASTER... DISCHARGE 30% FASTER!

WITH BATTERY-POWERED SHUTTLE CARS

Proved By 95 Time Studies

These figures are the results of 95 time studies made in all types of mines from Pennsylvania to Illinois!*

These studies show amazing performance and production records for battery-powered shuttle cars. Examples: They TRAVEL 25% FASTER . . . DISCHARGE 30% FASTER . . . DO 22% MORE WORK . . . and CAN PRODUCE 10% MORE TONNAGE. Another independent survey estimates that battery cars reduce coal mining costs in shuttle car sections by approximately one-half cent per ton,** and in hand-loaded sections, as much as 75 cents per ton.

Full facts on the unequalled safety, production, performance and economy of battery-powered shuttle cars are revealed in "A Report of Nine Shuttle Car Operation based on 95 Published Time Studies." For your free copy, write to Dept. M-119.

*Evaluation of Underground Loading and Haulage Machines, Michaanual, 1947.

**Shuttle Car Haulage, AIME, Technical Publication No. 2198.

Battery-powered shuttle cars have the following advantages demonstrated and proved:

SAFETY
Only battery cars are "permissible"

PRODUCTION
Can produce 10% more tonnage
Deliver more tons per man shift
Give 22% more ton-miles per shuttle car hour

PERFORMANCE
Include all design advances
Travel 25% faster
Discharge 30% faster
Are more dependable and predictable
Handle supplies easier
Reduce shuttle car change time
Can gob underground
Promote section efficiency

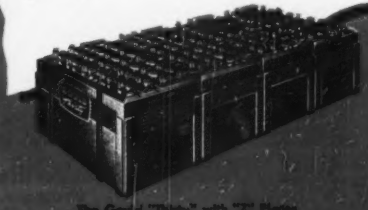
COST
Equal capital cost
Produce coal in shuttle car sections for approximately ½c less per ton** —in hand-loaded sections, as much as 75c a ton

A "MUST" FOR CONTINUOUS MINING MACHINES

Battery-powered shuttle cars enable continuous mining machines to work 10% more of the shift.

AND . . .

Two-shift operation is now possible with only one set of batteries.



The Gould "Thirty", with "Z" Plates
More than ever—
America's Finest Mining Battery

GOULD

STORAGE BATTERIES

GOULD-NATIONAL BATTERIES, INC.*
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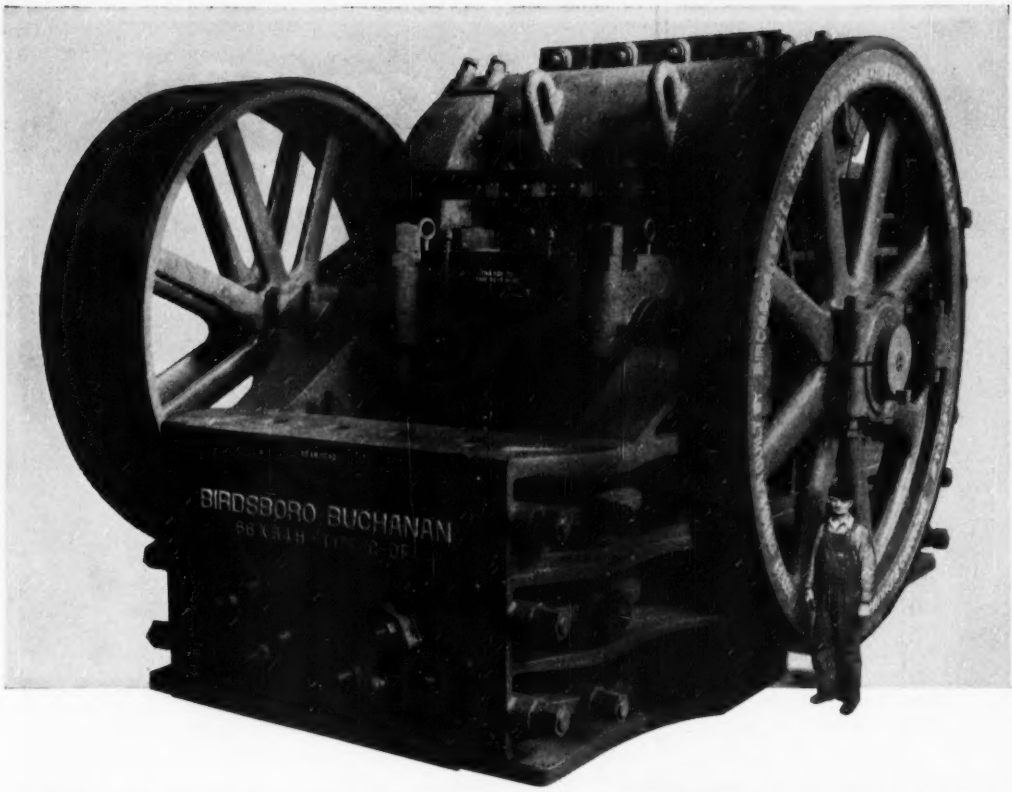
Always Use Gould-National Automobile and Truck Batteries



THE LARGEST DEEP FRAME CRUSHER EVER BUILT

OFFSET TOE LUGS THAT NEVER WEAR OFF—

a patented Birdsboro development and standard equipment on all Birdsboro deep frame crushers. They are offset from the face of the jaw plate and allow 100% or more useful plate life.

Canadian Representative & Manufacturer
JOHN INGLIS CO., LTD.
TORONTO, CANADA

World-Wide Agent Representation. Contact home office for nearest representative.

Designed and Manufactured by

BIRDSBORO

One of the largest crushing jobs ever attempted with a jaw crusher has been solved with this giant BIRDSBORO-BUCHANAN 66″ x 84″ deep frame jaw crusher. With this large receiving opening this crusher will take the feed from a 5 cubic yard shovel crushing the material down to 10″ to 12″ product at the rate of approximately 1,000 tons per hour. Immense power, high strength and long life have been built into this crusher to provide continuous and dependable crushing service. When you have a crushing problem, regardless of the size of your operation, it will be to your economical advantage to call in Birdsboro engineers.

BIRDSBORO
STEEL FOUNDRY & MACHINE CO.
Birdsboro, Penna.

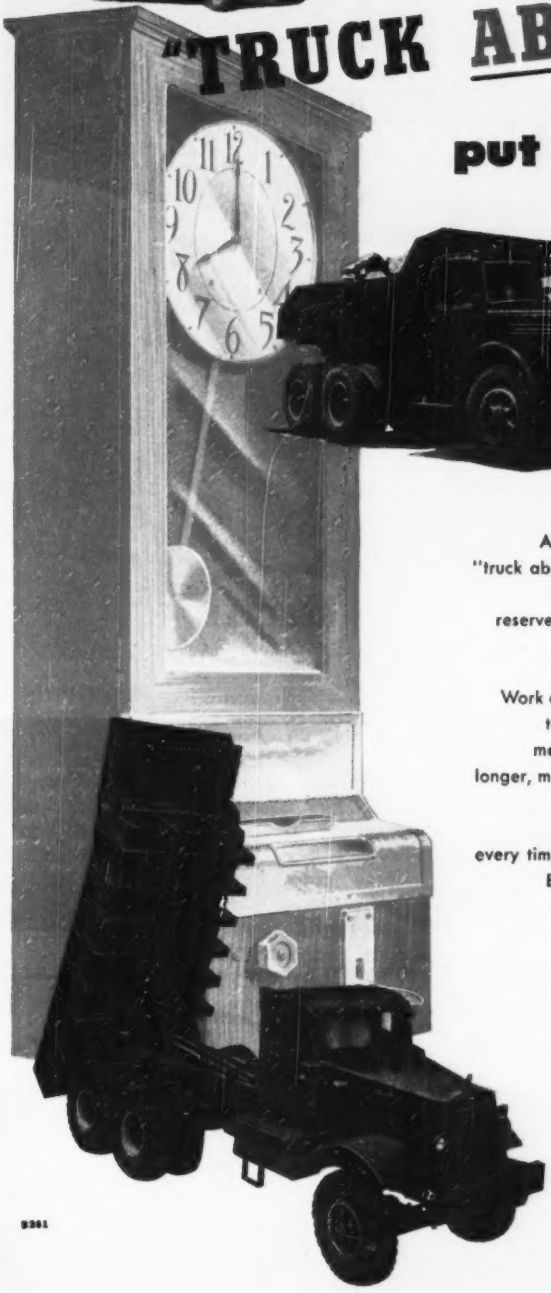
BIRDSBORO BUCHANAN JAW CRUSHERS

Designers and Builders of:
Crushing Machinery • Rolls • Steel Mill Machinery
Hydraulic Presses • Special Machinery • Steel Castings

...Cut Down

"TRUCK ABSENTEEISM"

put MACK TRUCKS on your job



"Truck Absenteeism," like its human counterpart, disrupts the efficiency of your business . . . adds materially to your costs. Actual job records prove that with Mack trucks on the job "truck absenteeism" is reduced to an absolute minimum. That's because Mack trucks have built-in durability . . . extra reserves of strength and stamina. Because they're better built, they're better able to stand up to the demands of hard-working, day-in, day-out service. Work done on the job will always be the one true yardstick of truck value. Figured that way, every Mack truck gives full measure — and more — in round-the-clock dependability; longer, more trouble-free mileage life; sustained earning power; and rock-bottom maintenance costs. On the job — and on the job records — it proves out every time: "YOU GET MORE WORK *OUT* OF MACK TRUCKS, BECAUSE MORE WORK GOES *INTO* MACK TRUCKS."

Be Profit-Wise

Modernize with

9361

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

Over sharp rocks—through slush, gravel, mud and deep ruts... GENERAL moves more tons out and over the highways

EASIER! FASTER! SAFER! CHEAPER!

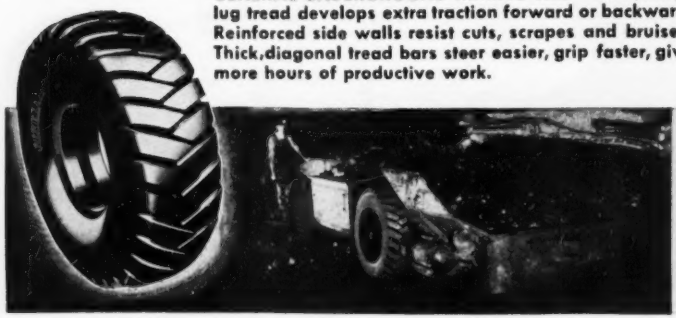
For most work off the road

GENERAL L. C. M.—thick, tough, deep lugs resist cuts, bruises. Tremendous self-cleaning tread develops extra traction forward or backward.

For most work on the road

GENERAL H. C. T.—tough, broad tread wears longer, has more traction. Free-rolling tread ribs steer easier, stop quicker on the highway.

GENERAL UNDERGROUND MINING TIRE—wide, deep-lug tread develops extra traction forward or backward. Reinforced side walls resist cuts, scrapes and bruises. Thick, diagonal tread bars steer easier, grip faster, give more hours of productive work.



THE GENERAL TRUCK TIRE

SPECIFY GENERAL TIRES ON YOUR NEW EQUIPMENT

"HERCULES"
REG. U.S. PAT. OFF.
RED-STRAND
WIRE ROPE

There are many reasons why it REPEATS

...and they are important to every wire rope user

Results are the most accurate means of measuring true value. And it is because so many users of "HERCULES" (Red-Strand) Wire Rope *have* measured it by this yardstick, that it is called on for so many "repeat" performances; that, too, is the reason why it has been so generally accepted, in one industry after another.

What are the reasons for the outstanding service of this particular wire rope? First, it is the product of over half a century of manufacturing experience . . . it is made of acid open hearth steel wire . . . it is the correctly balanced combination of strength, toughness and durability . . . its uniformity is maintained by advanced methods of manufacture, rigid tests and careful inspections.

As "HERCULES" (Red-Strand) Wire Rope is made in both Round Strand and Flattened Strand constructions—either Preformed or Non-Preformed, there is in this one grade, a "right rope" for any heavy duty job, and our Engineering Department will be glad to help you make the correct selection.

We Invite Your Inquiries

For safe, dependable and economical wire rope service, you can depend on the Red-Strand.

MADE ONLY BY

A. LESCHEN & SONS ROPE CO. 5909 KENNERLY AVE. • ST. LOUIS 12, MO.

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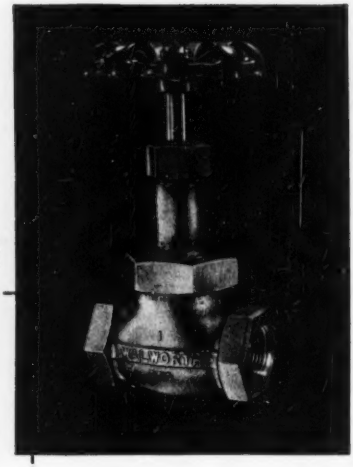


take a good look at the Walworth "500 Brinell" no. 225P Globe

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 277P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION, DEEP STUFFING BOX AND RUGGED STUFFING NUT: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.

EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,000 psi.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

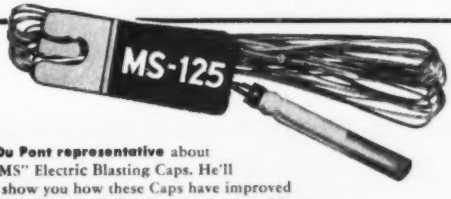
BETTER BREAKAGE COSTS LESS

with Du Pont "MS" Delay Electric Blasting Caps

Excellent fragmentation in this large Missouri limestone mine is typical of superior results obtained with Du Pont "MS" Delay Caps. These caps help boost production and lower costs by sharply reducing the need for secondary blasting while producing a minimum of spalls.

Limestone is mined by means of a bottom heading and five inverted benches producing huge rooms with pillars 80 feet high. Blasting is done with Du Pont "Gelex" No. 1 and No. 3, using Du Pont "MS" (Millisecond) Delay Electric Blasting Caps. Caps are available in fourteen intervals of delay, ranging from MS-25 to MS-500.

Drill Pattern is three rows of horizontal holes in each inverted bench. Benches are over 50 feet long. Using "MS" Delays, miners report less concussion and vibration than with previous firing methods. And "MS" Delay Caps save on dynamite costs, too. For explosive charges can usually be reduced when these Caps are on the job.



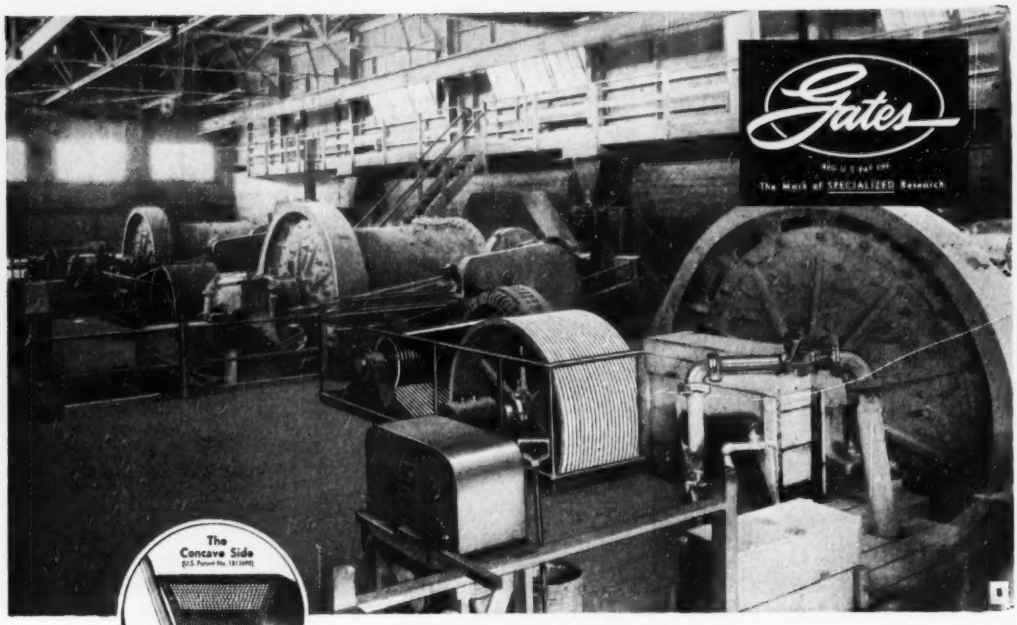
Ask your Du Pont representative about Du Pont "MS" Electric Blasting Caps. He'll be glad to show you how these Caps have improved fragmentation in many underground mines, and how they may be of help to you. E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.

DU PONT EXPLOSIVES

Blasting Supplies and Accessories

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



Profits of Bagdad Copper Corporation's isolated Arizona plant depended on maintaining economical and trouble-free operation. They chose the Gates Vulco Rope Drives (shown) for these big ball mills because of their proven ability to handle this rugged service. Also, because the failure of one belt would not necessitate a shutdown, but would give ample notice when a replacement set of belts was needed.

Let this simple test tell you exactly WHY the Concave Side cuts your V-Belt costs

To see for yourself the belt-saving importance of the Concave Side, just pick up *any* V-belt and bend it as it bends when it goes around a pulley.

As the belt bends, grip its *sides* firmly with your fingers. You will feel the sides of the belt *change shape.* This is because the top of the belt is under tension and, hence, grows *narrower* while the body, under compression, *bulges out.* (See figure 1 and 1-A)

Now look at figures 2 and 2-A. There you see how the bending changes the shape of the belt that is built with the Concave Side —The Gates Vulco Rope. The concave sides of this belt merely *fill out* and become perfectly *straight.* There is no side-bulge. This belt, when bent, *precisely fits its sheave groove.*

A very distinct saving in belt wear results. No side-bulge means that the sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in longer life for the sidewall and, naturally, *longer life for the belt!*

If you care about cutting your belt costs, it will pay you to make sure, whenever you buy V-Belts, that you get the V-Belt with the Concave Sides...the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear at Point Shown by Arrows.

Gates Vulco Rope with Concave Side

The Concave Side Fills Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-508

THE GATES RUBBER COMPANY
DENVER, U.S.A.
World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U.S. and 71 Foreign Countries

Euclid... Specialist

IN

OFF-THE-HIGHWAY HAULING EQUIPMENT

Built by a pioneer manufacturer of earth moving equipment, Euclids incorporate the know-how of years of experience. Every Euclid model is engineered specifically for off-the-highway work; all of the production and service facilities of Euclid are devoted to this type of equipment.

Heavy-duty design and construction throughout assure long life and dependable performance ... more loads per hour and more profit per load on the toughest jobs. Some of the Euclid-built features are the planetary type drive axle, frame and body on all models, and double-acting hydraulic hoist for Rear-Dump and Side-Dump "Eucs".

Owners can depend on Euclid's world-wide distributor organization for parts and service when and where they are needed. Call or write your Euclid Distributor for complete information on models best suited for your job requirements.

The EUCLID ROAD MACHINERY Co., Cleveland 17, Ohio

EUCLIDS *Move the Earth*

for faster drilling on any *location* at any *angle*

Providing fast and easy operation of the more powerful CP Drifter Drills (3½-inch and 4-inch cylinder bore), the medium-weight G-200R WAGON DRILL can be used anywhere — for drilling vertically, horizontally, or at any angle.

A sliding cone, with a 36-inch adjustment, offsets ground irregularities and uneven steel lengths. The flexible mounting makes it quickly adjustable for toe-hole drilling or bench drilling; its wheels swivel for line drilling or drilling close to face. Its CP rotary air motor gives a steady feed and quick return, with plenty of power for pulling tight steel.

* * *

The **new G-150** — an outstanding combination of wagon drill and mounting — is designed for use with the new 59-pound Sinker or the 3-inch Drifter. Increases footage up to 100% over hand-held methods.

Write for SP-3010 describing the many outstanding features of this light-weight wagon drill.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

An important CHROME-MAGNESITE Refractory for metallurgical furnaces

- HIGH TEMPERATURE STABILITY IN STRENGTH AND VOLUME
- GOOD SPALLING RESISTANCE
- HIGHLY RESISTANT TO SLAGGING AND EROSION

CHROMEX B is an extremely hard burned, dense, basic refractory especially suited for use under severe service conditions in vulnerable parts of smelting, refining and melting furnaces.

Important Uses of CHROMEX B include—

Copper and nickel converter linings
Copper refining furnace walls
Aluminum melting furnace bottoms
Lead dross reverberatory furnace walls and roofs
Copper blast furnace hearths and setters
Non-ferrous secondary metal furnace parts

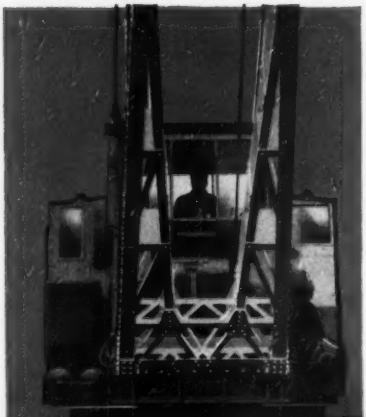
Harbison-Walker Products comprise all types and classes of commercial basic, silica, alumina-silica, and alumina refractories.

TRADE MARK
REG. U.S. PAT. OFF.

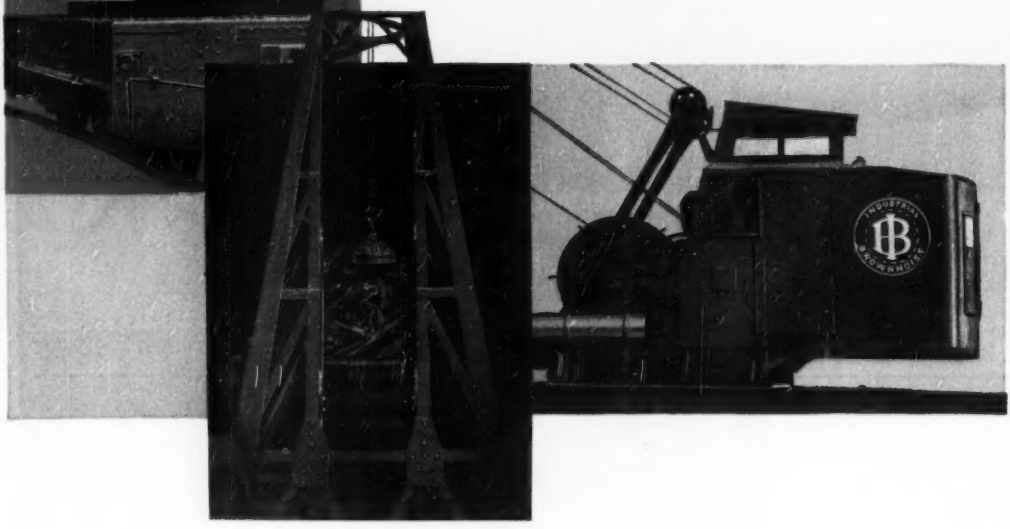
Harbison-Walker Refractories Company
AND SUBSIDIARIES
WORLD'S LARGEST PRODUCER OF REFRACTORIES
General Offices . . . . . Pittsburgh 22, Pennsylvania

NO BLIND SPOTS IN THIS CAB!

EXCLUSIVE BROWNHOIST "MONITOR-TYPE" CAB GIVES CRANE OPERATORS CLEAR FULL-CIRCLE VISIBILITY . . .



The patented Monitor-type cab, available only on Industrial Brownhoist Locomotive Cranes, is the one and only crane cab that provides a clear view from every angle — it's the one cab that allows full 360° visibility at all times — to the *front, sides* and *rear*. That's because the Monitor-type cab is fully enclosed with large windows and is placed *high on top of the crane.* The operator is *above* all machinery or braces that might obstruct his vision. He can speedily, accurately, and efficiently load or unload from high-walled railroad cars because he can look *right into* the car. Hoist and boom drums are in full view. To further insure good visibility, all Brownhoist cranes are equipped with the clear-vision boom that permits the operator to look right through it with unobstructed visibility.



In addition to full-circle visibility, the Monitor-type cab is designed to afford the utmost in comfort and safety including doors on both sides and 14" safety clearance between car and rotating upperworks. There is a soundproof partition between the operator and machinery — provision for opening all windows and doors for full ventilation — all operating controls are easily reached from a comfortable, well raised seat. Write today for more facts complete with specifications.

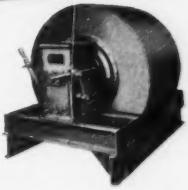
BROWNHOIST BUILDS BETTER CRANES

INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN • **DISTRICT OFFICES:** New York, Philadelphia, Pittsburgh, Cleveland, Chicago, San Francisco, Canadian Brownhoist Ltd., Montreal, Quebec. **AGENCIES:** Detroit, Birmingham, Houston, Los Angeles, Portland, Seattle, Spokane.

You Can Cut Today's High Production Costs with STURTEVANT EQUIPMENT

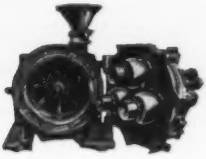
AIR SEPARATOR

For separation of fines to 325 mesh and finer. Increases output from 25% to 300% . . . lowers power costs by 50%. For years, this separator has been the standard in the cement industry.



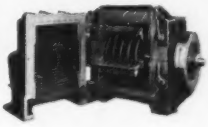
DUSTLESS BLENDER

Four-way mixing action assures a thoroughly blended product. Open-door accessibility permits easy cleaning. Available in many mixing capacities for ¼ ton per hour and up.



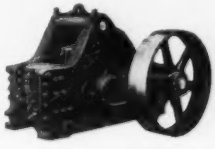
RING-ROLL MILLS

For medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operate in closed circuit with Screen or Air Separator. Open-door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



SWING-SLEDGE MILLS

For coarse and medium reduction (1" to 20 mesh). Open-door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.



JAW CRUSHERS

For coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.

Sturtevant equipment, such as illustrated, helps you overcome high labor and production costs by increasing output. In addition, their rugged construction assures long life with minimum maintenance. It will pay you to investigate these machines. Write for information.

STURTEVANT MILL COMPANY

101-A CLAYTON STREET, BOSTON 22, MASS.

MAIL COUPON TODAY!

STURTEVANT MILL COMPANY
101-A Clayton Street, Boston 22, Mass.

Gentlemen:
Please send me your catalog. I am especially interested in _____

Name _____

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City & State _____

Directional reverses come with machine gun speed for the transmission belt shown above. It's Republic's Challenger Belting on a reverse power drive installation at Stantonsburg Lumber Company, Stantonsburg, North Carolina.

Constant reverse flexing like this is tough on any belt, yet Republic's Challenger, now in its third straight year of continuous service, shows no signs of tiring.

Of course, Republic Challenger Transmission Belting is designed for heavy industrial drives where shocks and stresses are encountered, and is also perfectly suited to high-speed drives operating over small pulleys.

Challenger is a *pre-stretched* belt that doesn't loosen when pulling extra heavy loads. It's a belt that's free from fastener trouble because it is built with hard-woven duck. All edges are sealed against moisture.

Ask your local Republic Distributor about Challenger Belting today or write direct for information. Standard widths and plies are available in both roll or endless lengths. Both top and bottom surfaces have non-slip friction for better pulley traction.

See Your Local Republic Distributor

Close contact with experts like the Taylor Parker Company, Republic's Distributor in Norfolk, Virginia, who installed this Challenger Transmission Belt, assures success in industrial rubber applications. Contact your local Republic Distributor now about all your problems in . . . . HOSE, BELTING, PACKING and EXTRUDED and MOLDED RUBBER PRODUCTS.

INDUSTRIAL RUBBER PRODUCTS BY

REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation

YOUNGSTOWN, OHIO

Machine illustrated has Diesel power with electric swing. Also available as full Ward-Leonard Electric machine.

MARION gave the industry a new conception of excavating equipment in 1946 when the MARION 111-M was introduced. Here was a 3½-4 cu. yd. machine with all of the benefits of Diesel power PLUS all of the advantages of electric swing. Big enough for high daily yardage, yet easily moved from one job to another. Power enough to stand up to big jobs without flinching. Heavy enough to be steady on its long, wide crawlers.

Now—the MARION 111-M is bigger and stronger—better than ever. It is a thoroughly field-proven machine, piling up performance records that are truly impressive. (Write for copies of letters from 111-M owners.)

Regardless of whether you have seen the MARION 111-M before, you should see it today if a 3½-4 cu. yd. machine has a logical place in your operations. It's a rugged, heavy machine as a shovel or dragline with power and strength to spare.

The 111-M is an important new tool for heavy-duty material handling. Get the full story from your MARION representative or write to the factory for information.

MARION POWER SHOVEL COMPANY

MARION, OHIO, U.S.A.

Offices and Warehouses in all Principal Cities • Established 1884

J. Howard Morgan, secretary-treasurer of the Cedar Heights Coal Company, Oak Hill, Ohio, makes that statement about the new International TD-24 working on the company's stripping operations. "We are completely sold on International equipment," says Mr. Morgan. "We use four units in our operation here and they can't be beat. In six months use we have had no repairs except one minor item. This TD-24 looks like it will duplicate the endurance of our International TD-18 which operated two years before the engine was touched."

This is a statement by one more highly satisfied TD-24 owner. Never before has a tractor been so perfectly adapted to strip mining operations. The broad range of speeds, eight forward and eight reverse, on-the-go shifting with synchromesh transmission and the separate forward-reverse shifting lever combine to make the TD-24 the ideal tractor for strip mining. When you add the unequalled ease of control provided by "Planet Power" drive you'll find the TD-24 a matchless crawler when there's dirt to be moved.

If you haven't already seen the new TD-24, now is the time to visit your International Industrial Power Distributor. Let him give you a demonstration of this "Champion of Crawlers." When you see it work you, too, will say the TD-24 is "perfect" for strip mining operations.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

Standardize on Power that Pays

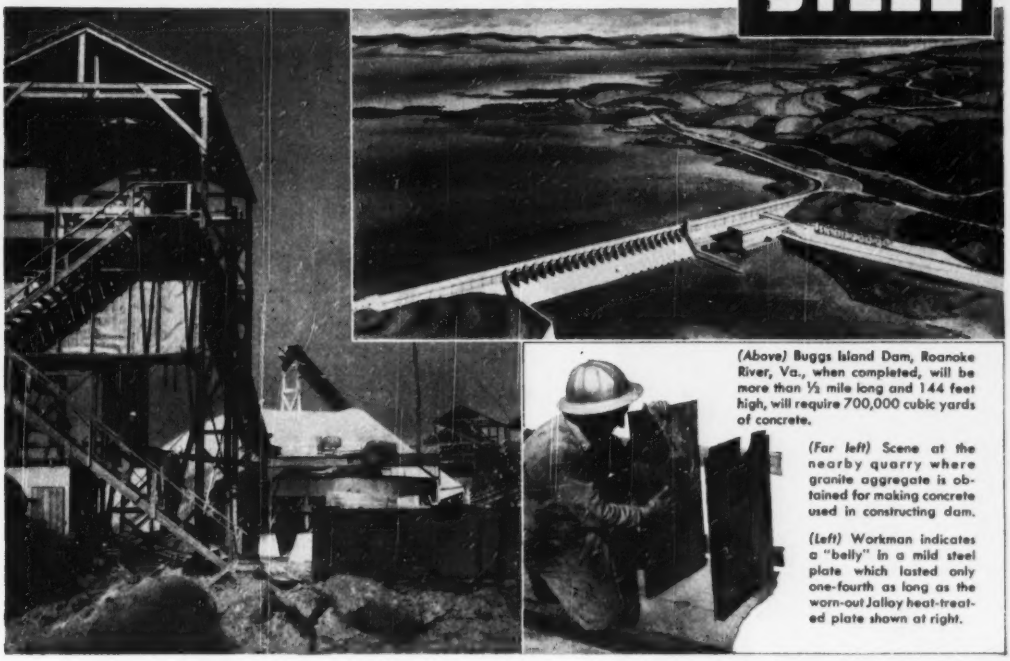
INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

CRAWLER TRACTORS • WHEEL TRACTORS • DIESEL ENGINES • POWER UNITS

$12,500 SAVED in construction equipment maintenance with first 45 tons of Heat-treated JALLOY STEEL PLATE

J&L STEEL



(Above) Buggs Island Dam, Roanoke River, Va., when completed, will be more than ½ mile long and 144 feet high, will require 700,000 cubic yards of concrete.

(Far left) Scene at the nearby quarry where granite aggregate is obtained for making concrete used in constructing dam.

(Left) Workman indicates a "belly" in a mild steel plate which lasted only one-fourth as long as the worn-out Jalloy heat-treated plate shown at right.

JALLOY Heat-Treated Plate lasts 4 to 5 times as long as mild steel in handling crushed stone for Buggs Island Dam

Buggs Island Dam, across the Roanoke River near South Hill, Va., is being constructed by Department of the Army, Corps of Engineers, Norfolk District. Granite is blasted from a quarry three miles from the dam site and crushed into various sizes. In moving and handling this hard abrasive rock, *worthwhile* savings are being made by using heat-treated JALLOY plate for: Chutes, screening equipment, truck bodies, shovel-dipper teeth and similar materials-handling applications.

At the quarry, operated by Ralph E. Mills and Gorman Bros., Inc., direct comparisons show that heat-treated JALLOY plate lasts an average of 5 times as long as mild steel. During the first 11 months, approximately 25 tons of JALLOY heat-treated plate were installed at the quarry.

At the dam, Jones-Tompkins-Wright, Contractors, installed approximately 20 tons of heat-treated JALLOY plate during the first 10 months of operations. Here JALLOY lasts on an average of 4 times as long as mild steel.

At both locations, approximately 45 tons of JALLOY heat-treated plate have effected a saving in the cost of steel for maintenance alone of more than $10,000. Labor savings in man-hours worked by maintenance crews have been conservatively estimated at more than $2,500.

Wherever heat-treated JALLOY plate is used to resist abrasion and impact, similar results are being obtained. Little wonder that this manganese moly steel is becoming so popular in materials-handling operations. Let us send you our booklet, "For Longer Wear . . . Less Repair." It describes how others are saving money with heat-treated JALLOY Steel Plate, The Mining and Quarrying Steel.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 30, Pa.

Please send me a copy of: "For Longer Wear . . . Less Repair—JALLOY—J&L Special Alloy Steel."

NAME_____

COMPANY_____

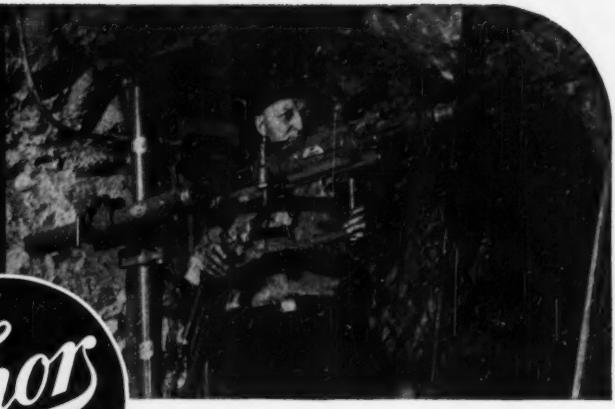
ADDRESS_____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

REVERSE FEED OR STANDARD FEED



Thor

STOPERS

THREE SIZES • TWO STYLES SIX MODELS

From the compact Model 200 to the heavyweight 600... here is drilling versatility to meet every hard rock requirement.

REVERSE FEED MODELS are now available in all sizes, permitting column or bar-mounting as shown in illustration above.

Simple design, air cushioning, extra large bearing surfaces and other features keep these tools on the job longer, *sharply reduce out-of-service repairtime.*

For on the job demonstrations of any of these great new Thor Stopers, write or wire Independent Pneumatic Tool Co., Aurora, Ill., or Los Angeles, Calif.

STOPER LEG

Adapts Thor No. 38 Sinker to double duty as either Sinker or Stoper — Air Feed Leg bolts directly on cylinder, replacing Sinker backhead, Write for Circular JE-1132.

... Thor PORTABLE POWER TOOLS

ELECTRIC • PNEUMATIC

Step Up Recoveries

WITH THESE TWO FLOTATION "FIRSTS"

Yarmor® F Pine Oil

Hercules "Yarmor" F Pine Oil has been a standard of quality among pine oils ever since the flotation process became established. Low in cost, it is recognized as the ideal frother for the flotation of sulphide minerals, such as zinc, copper, lead . . . and for non-sulphide minerals, such as mica, quartz, graphite, feldspar, and talc. A relatively new and profitable use is in the salvaging of coal fines for fuel. Here, as wherever a highly mineralized froth is required to support and hold heavy concentrations, "Yarmor" F Pine Oil assures maximum recovery.

Rosin Amine D Acetate

Rosin Amine D Acetate is a new type of collector developed by Hercules for the flotation process. This cationic surface-active material is low in price, has good solubility, and is easy to handle. Rosin Amine D Acetate is employed in the flotation of non-metallic ores, such as feldspar, cement rock, and phosphate rock. It is an excellent collector for silica and siliceous minerals and may have application in the removal of these substances from other ores. Hercules Rosin Amine D Acetate is shipped to flotation users in the form of a water-soluble, 70 per cent paste.

Send for new technical book on Hercules flotation agents

HERCULES POWDER COMPANY

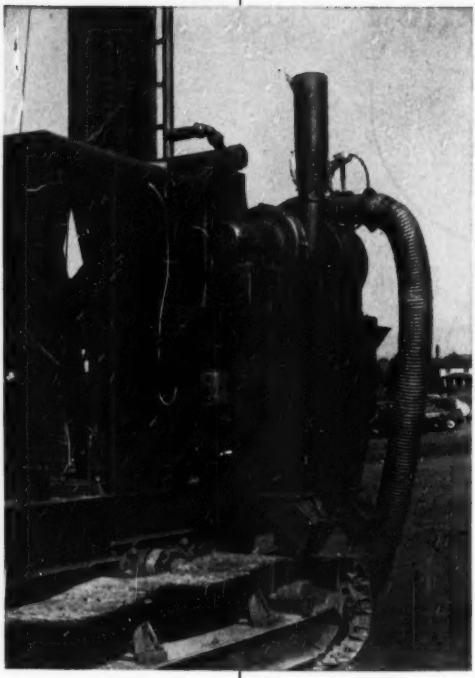
INCORPORATED

933 KING STREET, WILMINGTON 99, DELAWARE

NM50-2

High speed rock drills need good dust control

New Ingersoll-Rand Quarrymaster includes AAF Roto-Clone Dust Control



DUST is no problem with the new high speed Ingersoll-Rand Quarrymaster rock drill. It's equipped with an AAF Type D Roto-Clone* and Skimmer Precleaner.

Here's how it works. Dust and chips are forced to the surface by compressed air. At this point Roto-Clone takes over. Chips and heavy dust content are first removed from the air stream by the Skimmer Precleaner and the remaining fine dust is then collected by the Roto-Clone. All collected material is discharged into storage hoppers for easy removal. Result—a practically dust-free operation with no accumulation of chips around drill hole. Basic design of the Roto-Clone unit assures exhausting of a constant air volume at all times plus maintenance-free operation.

This is but one of many dust control jobs assigned to Roto-Clone in rock products and mining operations. There's a type and size to handle every production problem. For complete Roto-Clone information, call your local AAF representative or write direct to—

*Roto-Clone is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

AMERICAN AIR FILTER CO., INC.

107 Central Avenue, Louisville 8, Ky.

In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF

ROTO-CLONE®

DUST CONTROL EQUIPMENT

Have you heard about the *NEW* T5X?

Fortified with *new* compounds, the amazing purple oil now offers you greater engine protection than ever before!

Surpasses "Supplement 1" specifications

The amazing *purple* oil is now better than ever! With even greater alkaline reserve, oxidation resistance, detergency and other upgraded qualities, the *new* T5X surpasses the exacting standards of U. S. Army Specification 2-104B, *Supplement 1*.

Its superiority has been clearly established in both the Coordinating Research Council gasoline engine tests and the rugged "Caterpillar" Diesel tests.

Protects *any* internal combustion engine

Powerful *new* additives have been compounded with a high VI, pure 100% paraffin base to form the *new* T5X. And its improved quality is so high that this great oil is recommended for *any* internal combustion engine operating under severe conditions.

Proved under critical field conditions

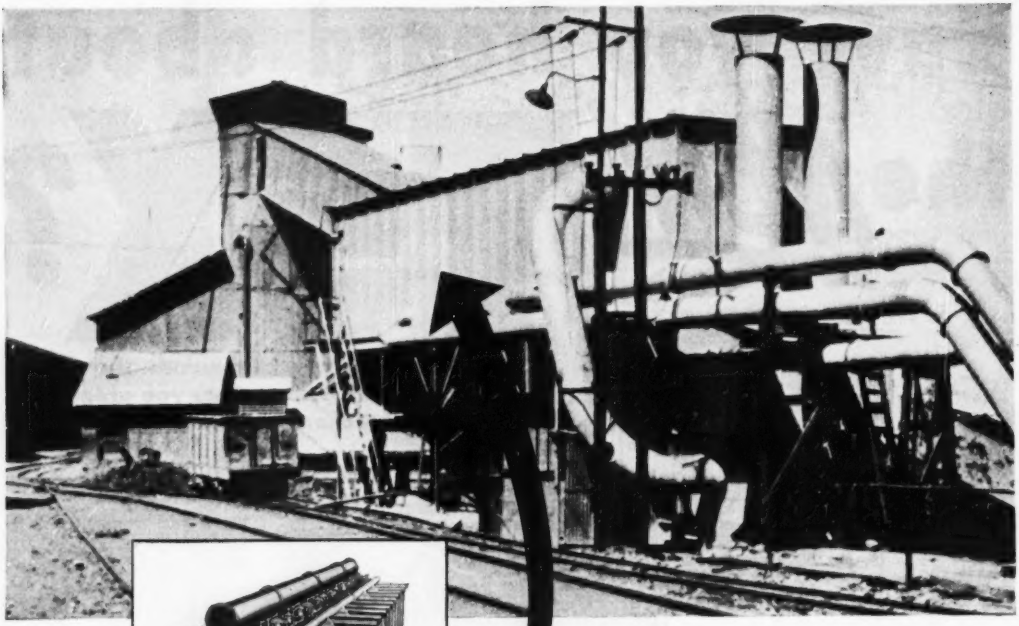
Field tests made by outside companies under critical operating conditions have *also* proved the amazing stability and performance of the *new* T5X in all types of equipment —including trucks, tractors, construction equipment, marine engines and varied types of stationary engines.

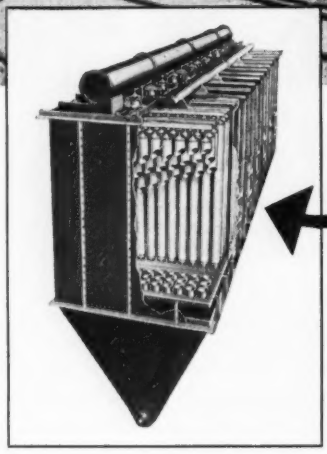
Substantially reduces engine wear

What the new, unusually high quality of T5X means to *you* is the opportunity for increased engine efficiency, less wear and lower maintenance and repair costs. And you can prove this for yourself by giving the *new* T5X a trial in your *own* equipment operating under severe conditions.

For full information about the new T5X, call your Union Oil Representative. Or write, wire or call Sales Dept., Union Oil Company, Los Angeles 17, Calif.

76 UNION OIL COMPANY OF CALIFORNIA





Norblo Bag Type

DUST AND FUME COLLECTION

One particular Norblo installation of Norblo Automatic Bag Type Dust Collectors (in tandem) moves more than *four million tons of air a year.* This unit is collecting a scarce and valuable metal previously recovered less efficiently. The difference represents a substantial increase in profit.

Pre-eminent in the smelting, mining, cement and rock products fields, Norblo Automatic Bag Type Dust and Fume Collection provides dependable, heavy duty continuous service at low cost. In the smelting field right now the extra production capacity of Norblo automatics is paying off handsomely. Write for Bulletin No. 164-2—today!

tackles the biggest jobs...

production at low cost

THE NORTHERN BLOWER COMPANY

6410 BARBERTON AVENUE • CLEVELAND 2, OHIO

Automatic and Standard Bag Type Fume and Dust Collectors • Norblo Centrifugal and Hydraulic Collectors • Cement Air Cooling Systems • Exhaust Fans

CHEMICO
announces
A NEW WAY
to make
Sulfuric Acid

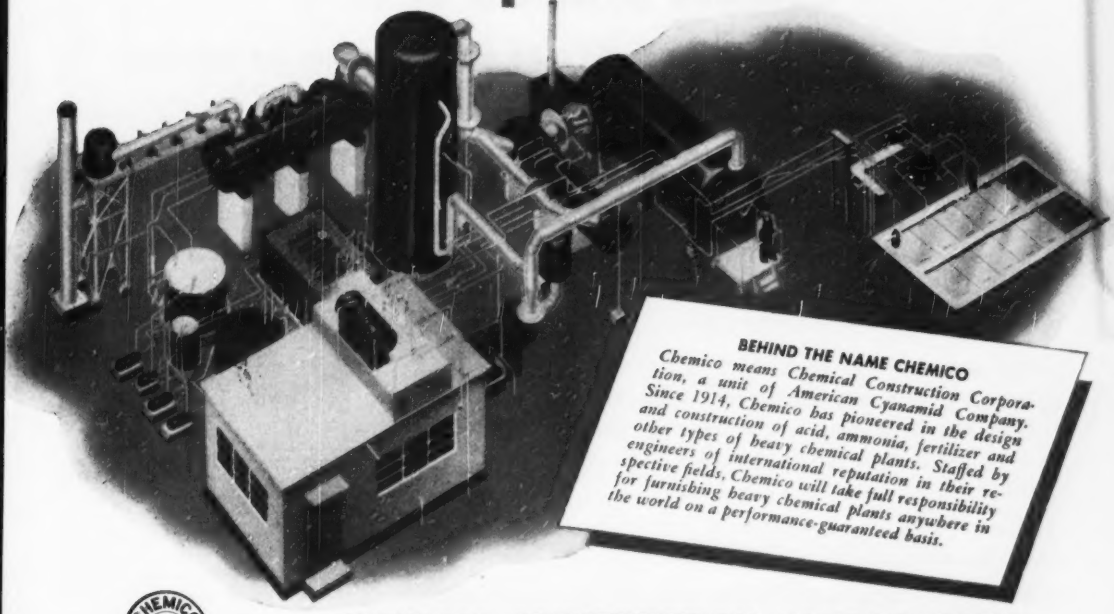
Whether you make or buy sulfuric acid, this simple new-type Chemico plant will be of special interest to you. Here's why . . .

Chemico's new process for manufacturing sulfuric acid from sulfur makes it possible for you to *replace* or *enlarge* your present facilities *at considerably less cost* than for the standard type contact plant.

The simplicity of this new Chemico plant is the basic reason for its low cost. *These seven major items of equipment* — usually found in present-type contact acid plants — *have been eliminated*: drying tower, gas filter, heat exchanger, SO_3 cooler, acid coolers, acid circulating and transfer pumps, and diluting equipment. In addition, the distinctive features listed below assure more efficient production.

DISTINCTIVE FEATURES

- A quench converter eliminates heat exchangers . . . assures higher yield from raw sulfur . . . virtually eliminates atmospheric contamination due to unconverted SO_2.
- A multiple-stage dip-pipe absorption system, operating by gravity flow, eliminates the need to distribute acid over packed absorbing towers.
- Water evaporation from absorber acid solutions removes heat of absorption and the sensible heat of the hot gases. Only the product acid requires cooling before storage.
- A built-in Pease-Anthony Venturi Scrubber insures mist elimination in the exhaust stack.
- Plants of this new type deliver sulfuric acid of any strength up to 95% H_2SO_4.



BEHIND THE NAME CHEMICO

Chemico means Chemical Construction Corporation, a unit of American Cyanamid Company. Since 1914, Chemico has pioneered in the design and construction of acid, ammonia, fertilizer and other types of heavy chemical plants. Staffed by engineers of international reputation in their respective fields, Chemico will take full responsibility for furnishing heavy chemical plants anywhere in the world on a performance-guaranteed basis.

Chemico plants are profitable investments

CHEMICAL CONSTRUCTION CORPORATION

CONSULTING, DESIGNING AND CONTRACTING ENGINEERS

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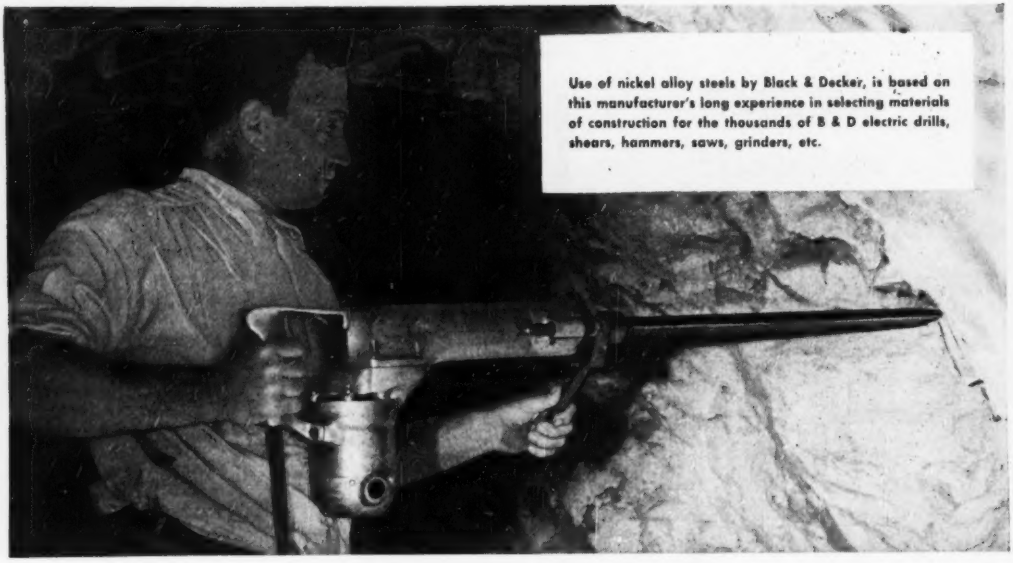
Use of nickel alloy steels by Black & Decker, is based on this manufacturer's long experience in selecting materials of construction for the thousands of B & D electric drills, shears, hammers, saws, grinders, etc.

Withstands terrific pounding...

because BLACK & DECKER uses Nickel Alloy Steel for extra stamina

Examine this "machine gun of industry" drilling shot holes in a mine . . .

This 2-inch Black & Decker electric hammer withstands repeated impacts, shock, wear and abrasion, because nickel alloy steels help to provide extra strength, toughness, and hardness in important parts.

Crank and pistons are machined from Type 4615 nickel-molybdenum steel, casehardened to assure high surface hardness supported by a tough core. Crank gears are turned from Type 3250 nickel-chromium steel, quenched and tempered for optimum strength and toughness. Various other hammer parts, including retainer rods, screws, studs and nuts are specified in Type 3140 nickel alloy steel.

The Black & Decker Manufacturing Company of Towson, Md., use nickel alloy steels to attain long service life . . . and correspondingly less maintenance, fewer replacements, and lower non-productive labor costs.

Nickel alloy steels offer significant advantages. Write for suggestions regarding the best type for your applications.

EMBLEM OF INCO SERVICE

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

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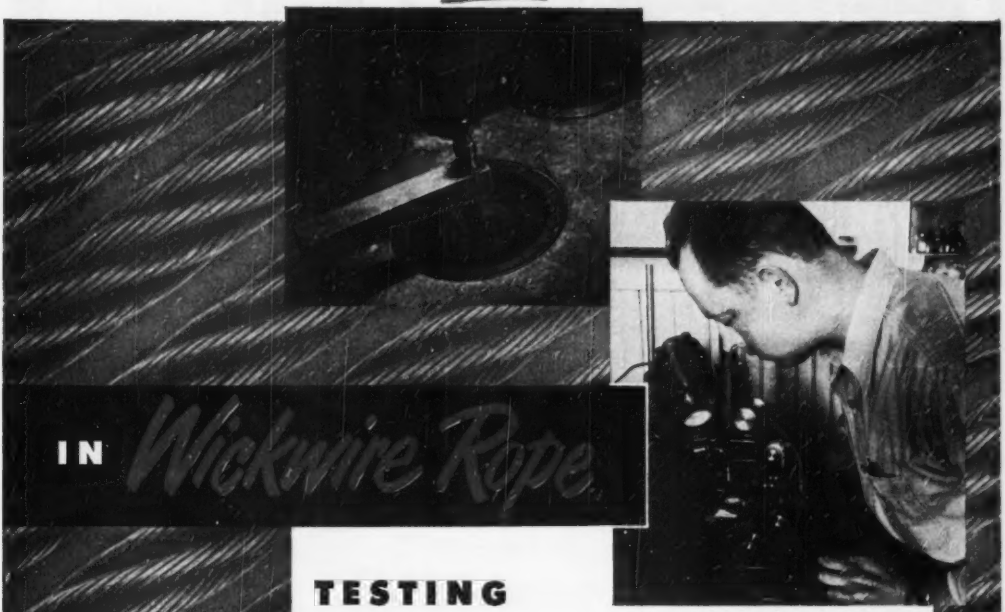

IN *Wickwire Rope*

TESTING GOES

Precision polishing and high powered magnification enable us to go 100 times beyond normal vision in examining Wickwire Rope steel for classification of grain size to McQuaid-Ehn* standards.

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Uniformity of grain size in steel assures longer life and greater reliability in Wickwire Rope.

Right down the line...starting with the melting and refining of our steel ...and continuing through heat treating processes and cold drawing of the wire, we maintain complete control over the grain size of steel used in Wickwire Rope.

This quality control of basic properties is possible only with a company whose operations are fully integrated from the actual making of the steel to the stranding of the finished rope. It's just one more example of how Wickwire goes "beyond specifications" to give you—at market prices—wire rope that is unsurpassed for reliability, safety and longer life.

See your local Wickwire distributor for the right rope for your particular requirements. Wickwire Rope is available in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed.

*For detailed information on the McQuaid-Ehn test and what it means to you in superior rope performance, write to Wire Rope Sales Office, Wickwire Spencer Steel Division of C. F. & I., Palmer, Mass.

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820 HAS PLENTY OF TURNTABLE ADVANTAGES

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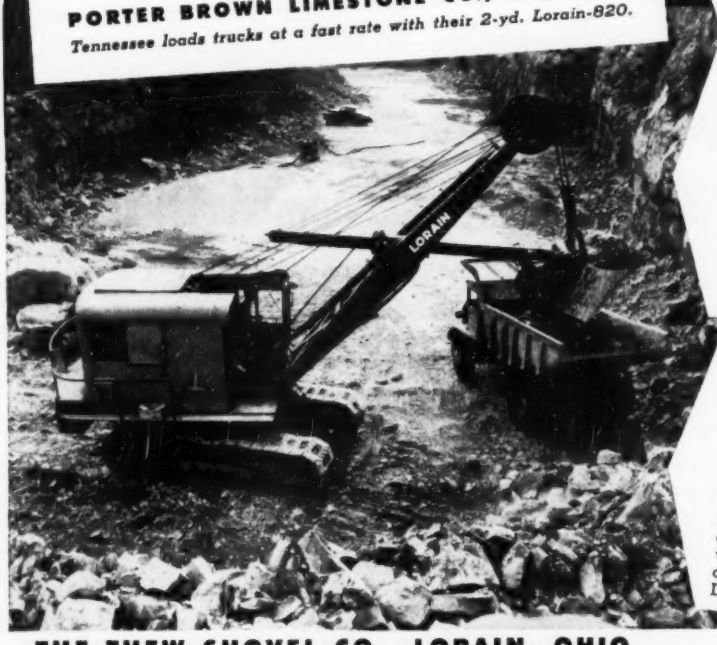
Got some *tough* digging? Put a Lorain-820 on the job . . . and watch things happen! Big Lorain-820's in the 2-yd. class, have the stamina to stick with the hardest materials . . . whether you're stripping from the top or gouging out the deepest cuts. From dipper to crawler, the "820" is built for those tough jobs. Check the list of features at the right—and then ask your Thew-Lorain Distributor to point them out to you on an "820" in action.

820 HAS PLENTY OF CRAWLER FEATURES

Independent crawler travel ★ Chain drive ★ Two speeds in either direction ★ Steers either direction ★ 4-way ratchet and pawl travel and tread lock ★ Propelling mechanism runs in oil bath ★ Wider treads—extra strong, heat-treated drop forgings

PORTER BROWN LIMESTONE CO., *of Springfield, Tennessee loads trucks at a fast rate with their 2-yd. Lorain-820.*



820 HAS PLENTY OF SHOVEL FEATURES

Positive chain crowd ★ All-welded, all-steel, torsion-resisting boom ★ All-steel dipper stick ★ Drop forged crowd rack ★ Power dipper trip—saves time and operator's energy ★ Automatic crowd brake to hold stick extended

820 HAS PLENTY OF CRANE, DRAG, CLAM FEATURES

Interchangeable to Cranes, Clams or Drags ★ Simultaneous hoist, swing and travel (or boom derricking) ★ Worm driven high speed boom hoist ★ All-purpose Crane Boom head—6 part line ★ High gantry available (power lowered) ★ "Cable-Miser" fairlead ★ Large diameter boom head sheave for Draglines

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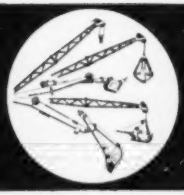
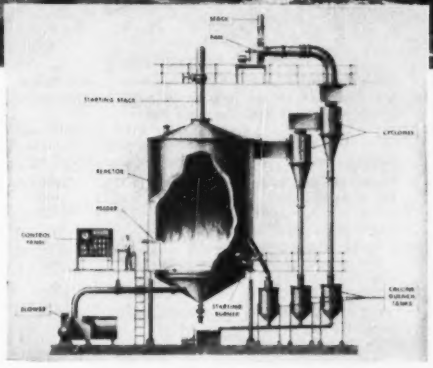


SHOVELS
CRANES
DRAGLINES
CLAMSHELLS
HOES

Another DORRCO FLUOSOLIDS SYSTEM for Canada's Red Lake district



Circled in the photo above is the FluoSolids building at Campbell Red Lake Mines Ltd. . . . another Dorrco FS System to be installed in Canada for the roasting of refractory arsenopyrite gold ores. With a design capacity of 65 tons per day, Campbell's FS System is roasting flotation concentrates for the elimination of arsenic and sulphur. The calcine is cyanided for gold recovery.

Three features of particular significance have been demonstrated at Campbell:

FIRST . . . the FS System is successfully roasting a concentrate containing only 18% sulphur . . . without auxiliary fuel.

SECOND . . . feed is being pumped to the FS Reactor as a slurry at 70 to 80% solids . . . without prior drying.

THIRD . . . it has been possible to shut down one shift per day with no difficulty experienced in returning to full operation.

Resultant low operating costs and low first cost as compared with conventional roasters make FluoSolids well worth careful investigation. If you have a roasting problem involving arsenopyrite or telluride gold ores we would like to give you further details.

DORRCO FLUOSOLIDS Systems employing single compartment reactors as illustrated are applicable to the roasting of refractory gold ore concentrates, copper and zinc concentrates, and pyrite.

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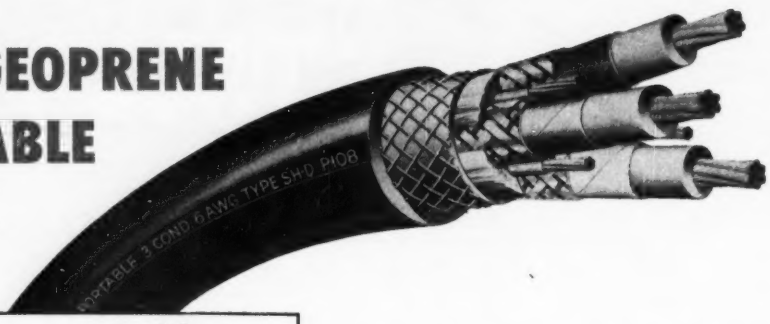
GEOPRENE PORTABLE CABLE



Compare—

and be convinced!

These figures, comparing ASTM requirements with typical G-E Geoprene values, indicate at once the superiority of portable cable with Geoprene sheath:

ORIGINAL	ASTM REQUIREMENTS	GEOPRENE TYPICAL VALUES
Tensile strength, lb/sq in.	1800	3000
Per cent elongation	300	500
Set in 2-in. test piece, in.	3/8	1/16
After 7 days in Geer oven at 70C		
Tensile strength, lb/sq in.	1600	2900
Per cent elongation	250	430
After 96 hrs. in oxygen bomb at 70C		
Tensile strength, lb/sq in.	1600	2800
Per cent elongation	250	430
After 18 hrs. in oil at 121 C		
Per cent depreciation in tensile strength	40	35
Per cent depreciation in elongation	40	35
Tear Test		
Tensile strength, min. lb/in.	40*	75

*This is the requirement for rubber jackets; no tear value has yet been set for neoprene-type jackets.

Look to G-E wire and cable
for continuing progress toward
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PER MACHINE PER DAY
Investigate these famous G-E cables for
big returns in mining operations:
Mine power cable insulated with Super Corona* . . . Versatol*-Geoprene portable cable . . . Bore hole cable . . . Varnished cambric cable . . . Locomotive cable . . . Flamenol* mine telephone cable . . . Shot firing cord . . . Deltabeston* power cable and magnet wire.
*Registered Trade Mark of General Electric Company

A portable cable whose jacket has much higher tensile strength than required by ASTM standards . . . more than twice the tear resistance of older-type jackets—that's General Electric Geoprene portable cable!

Give G-E Geoprene cable the hardest possible service—bury it under rock falls, maul it with heavy equipment, drag it behind mining machines, wind it off and on reels repeatedly—it's made to outlast cable made with natural rubber. And, at the same time, you'll get sizeable savings in replacement costs over types of cable that won't stand up under rough treatment.

Tough, cable-laid twine under the outer Geoprene sheath gives G-E portable cable additional strength. An inner jacket cushions conductors against hard knocks and operating abuses. And because high-voltage Geoprene portable cable is built to permit continued operation at 75 C, you can use sizes that are smaller, less bulky than otherwise possible.

Available in a wide range of sizes and with two, three, or four conductors, G-E Geoprene cable resists heat, sunlight, abrasion, oils, acids, alkalies, and flame. To find out about these and other advantages that this cable provides, write Section W18-995, Construction Materials Department, General Electric Company, Bridgeport 2, Conn.

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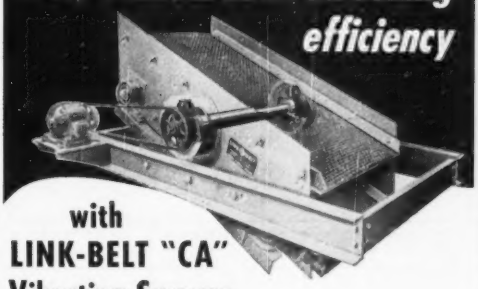

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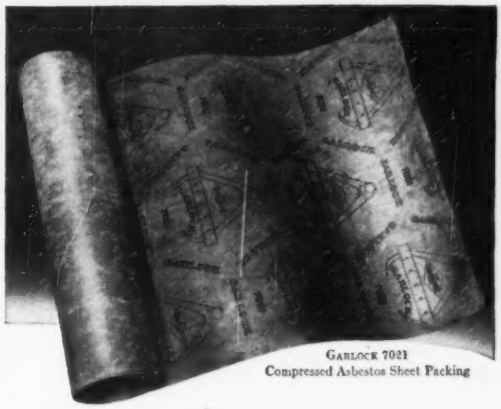

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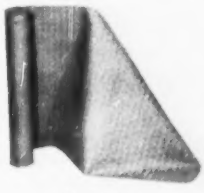
Red Rubber Sheet Packing



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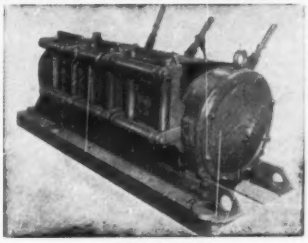

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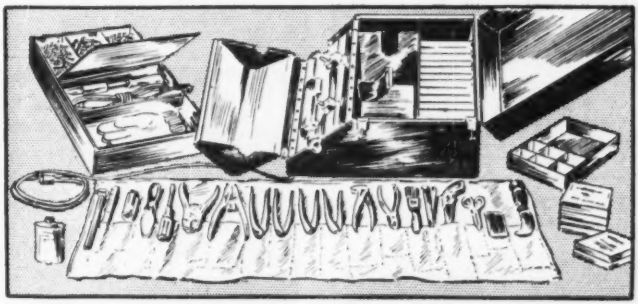

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18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
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30"	6	1/8"	1/16"	32 Oz.
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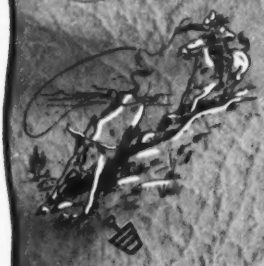

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